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WATER QUALITY BUREAU
MONTANA DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES

APPENDIXES FOR MONTANA WELLHEAD PROTECTION PROGRAM

PLEASE RETURN

DRAFT
MAY 8, 1992

DEC 1 1985

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APPENDIX A

MISSOULA AND POLSON WELLHEAD PROTECTION AREAS

DEVELOPMENT OF A WELLHEAD PROTECTION PROGRAM
FOR GROUNDWATER RESOURCES IN THE MISSOULA AQUIFER
MOUNTAIN WATER COMPANY
MISSOULA, MONTANA

EXECUTIVE SUMMARY

Mountain Water Company (MWC) operates the municipal water system for most of urban Missoula, Montana. MWC obtains its supply from a network of ground-water wells located within the Missoula Valley and completed in the Missoula Aquifer. Of the approximately 68,000 residents in the greater Missoula area, 50,000 rely on MWC for their source of drinking water.

Mountain Water Company (MWC) recognizes that public water supply wells in the Missoula Aquifer require a high level of protection due to past contamination events that have occurred and the apparent vulnerability of the aquifer from current land use activities. Hydrometrics, Inc. was hired by MWC to develop and facilitate implementation of a comprehensive wellhead protection (WHP) program for their water supply wells in the Missoula Valley.

The 1986 amendments to the Safe Drinking Water Act established a nationwide wellhead protection program to encourage states to develop regulations which protect public water supply wells and well fields from contamination. Montana currently does not have wellhead protection regulations and has only recently begun drafting a wellhead protection program. Mountain Water Company realizes that wellhead protection in the Missoula Aquifer is an essential safeguard requiring immediate attention and has taken a leading role in creating a program to protect public groundwater supply wells.

The format of this WHP program was taken primarily from guidance documents available from the U.S. Environmental Protection Agency (EPA). The EPA recommends that a WHP plan includes the following seven key elements:

- Specify roles and duties of State agencies, local government entities, and public water suppliers, with respect to WHP programs;
- Delineate the wellhead protection area (WHPA) for each wellhead;
- Identify sources of contaminants within each WHPA;
- Develop management approaches to protect the water supply within WHPAs from contaminants;
- Develop contingency plans for the public water supply system for response to well or wellfield contamination;
- Site new wells to maximize yield and minimize potential contamination; and
- Ensure public participation.

When implemented, the Missoula WHP program will reflect a cooperative effort between MWC, Missoula City and County agencies, and other public and private groups interested in preserving water quality in the Missoula Aquifer. The WHP program contains elements unique to the Missoula area and the State of Montana.

Of the seven elements recommended by the EPA, development of MWC's WHP program focused on three main tasks:

- Determine groundwater flow paths to MWC wells and delineate wellhead protection areas (WHPAs).
- Inventory potential contaminant sources in WHPAs.
- Identify and select suitable management approaches to protect groundwater quality in WHPAs.

The EPA provides guidance on the various criteria and technical methodologies that can be used to delineate WHPAs. The technical methods used to delineate WHPAs can be very simple or highly complex, depending on physical conditions and the level of protection desired. A computer-generated flow model was used to define groundwater flow paths and help delineate WHPAs for most of MWC wells. An existing computer groundwater model

originally developed by a University of Montana graduate student was modified to determine the zones of contribution (ZOC) to MWC wells in the main body of the Missoula Aquifer. Analytical modeling techniques were used to determine ZOCs to wells outside of the original computer model area (East Missoula, Rattlesnake and Momont areas). ZOC modeling to define groundwater flow boundaries for WHPAs is recommended by the EPA.

Concurrent with ZOC modeling, an inventory of potential contaminant sources was conducted to assess the threats to groundwater quality that currently exist in the area surrounding MWC wells. The potential sources were prioritized from perceived greatest to least threat as:

- Commercial Injection Wells
- Sewer Lines and Lift Stations
- Septic Systems
- Underground Storage Tanks and Pipelines
- Hazardous Materials Generators
- Stormwater System and Stormwater Sumps
- Landfills, Lagoons, etc.
- Truck and Rail Transportation Routes and Terminals
- Pesticide Applicators
- Miscellaneous Sources (photos, labs, mortuaries, etc.)
- Irrigation Ditches
- Water Wells

Wellhead protection areas for MWC wells were delineated based, in part, on the results of the potential contaminant source inventory and modeled ZOCs. In addition, the geography of Missoula, extent of urban development adjacent to MWC wells, and specific protection requirements for MWC were considered. These factors necessitated a zonation approach to delineating WHPAs. Three types of WHPA zones are recommended:

Zone 1: Critical WHPA

This zone would include a portion of the ZOC immediately surrounding the wellhead, in addition to a small transition or buffer zone. The downgradient and lateral boundaries of Zone 1 would roughly coincide with groundwater flow boundaries to the ZOC and include a 200-foot buffer zone. The upgradient boundary would be located 1,000 feet in the upgradient groundwater flow direction.

Zone 2: Primary WHPA
This zone would encompass all ZOCs to wells and include a transition or buffer zone of several hundred feet.

Zone 3: Peripheral WHPA
This zone would consist of adjacent and upland areas which could contribute groundwater and surface water recharge to Zone 2.

As potential contaminant sources were identified and WHPAs delineated, research was initiated to assess existing federal, state, and local regulations which could be incorporated in the WHP program. Existing regulatory authority available to the city and county of Missoula as it relates to potential techniques for WHPA management includes:

- Groundwater user regulations;
- General source controls;
- Specific source controls;
- Land use controls; and
- Inspection, containment and cleanup requirements.

A number of potential WHPA management options were identified from recommendations by the EPA and examples from WHP programs in other states. Management techniques are considered to be the "tools" which can be used to regulate land use practices to prevent groundwater contamination in WHPAs. Potential management tools which can be used in WHPA Zones 1, 2, and 3 include:

- Zoning Ordinances
- Municipal Ordinances
- Subdivision Regulations
- Design Standards
- Operating Standards
- Source Prohibitions
- Transaction Induced Investigations
- Groundwater Monitoring
- Public Education
- Local Water Quality Protection District
- Best Management Practices

The above management options were evaluated with respect to specific potential contaminant sources, implementability, and the level of protection it would afford MWC. The most restrictive management options (e.g., source prohibitions) were considered for WHPA Zone 1.

To identify the options that would be most appropriate for the Missoula area, political, social, economic, and legal issues were considered. Most communities around the country with WHP programs rely extensively on pre-development regulations (zoning, site plan review, etc.) as WHPA management tools. Unfortunately, MWC wells are located within a highly urbanized area of the Missoula Valley. Land use regulations such as zoning are not considered to be practical, and may not show a clear relationship between groundwater protection and the regulated land use. A better approach is to regulate the activity which uses substances posing a threat to groundwater quality. Regulating an activity, not the land use, would address specific threats and show a clear relationship between the activity and the protection of public health.

Of the potential management options, a municipal 'wellhead protection' ordinance is recommended as the principal management tool for the WHP program. The Public Water Supply Wellhead Protection Ordinance (WHPO) would regulate the handling, storage, use, production, and disposal of substances which have the potential to contaminate the Missoula Aquifer. As a municipal ordinance, the WHPO would cover areas outside of the city limits through the mayor's extraterritorial powers. Permit fees would be imposed on the regulated facility to cover the costs of administration. The permit fee would be based on the size of the facility and the volume of regulated substance at the facility. Certain facilities would be exempt from permit requirements such as businesses that sell packaged consumer products (e.g. department stores, supermarkets, etc.), and businesses that use small amounts of commercial office supplies. Key elements of the WHPO include:

- Regulated Substance Definition. Regulated substances would include petroleum products, organic solvents, and other materials which could contaminate groundwater.

- Substance Inventory The facility operator must prepare an inventory including the types and volumes of substances at the facility.

- RSMP A Regulated Substance Management Plan must be prepared which addresses how substances are used, stored, handled, produced or disposed, and what safeguards will be taken to prevent a release of the substance to the environment.

- EEP An Emergency Preparedness Plan must be developed which describes procedures for cleaning up spills and releases at the facility.

- USTs Underground tank owners would be required to conduct frequent monitoring and install double containment structures on all new tanks.

- Wellheads Existing and new public water supply wells must meet requisite construction standards, and security and protective measures for adjacent land area.

- WHPAs New activities that would use regulated substances would be prohibited in Zone 1. Existing facilities would be permitted as legal noncomplying. All facilities in Zone 2 would conform to the WHPO permit requirements. Facilities in Zone 3 would only need to submit an inventory to obtain a permit. The designation of new WHPAs and modifications to boundaries would be through the Missoula City Council.

The development of aquifer-wide wastewater and stormwater disposal policies was recommended as a long-term management approach to groundwater quality preservation. The City of Missoula, Missoula County, and the Missoula City-County Health Board would become active participants in promotion of groundwater protection by addressing the following issues:

- Revision of Wastewater Facilities Plan (201 Plan).

- Mandatory connection of facilities and residences that are currently adjacent to the municipal sewer system.

- Sewer line inspection and repair of leaky mains and service connections.

- Extension of sewer and water service within the Missoula Valley.

- Design of subdivision wastewater disposal systems for eventual connection to municipal sewer system.

Implementation of this WHP program is considered to be an important step to preserve groundwater quality adjacent to MWC wells in Missoula. However, it is only one component of an aquifer-wide management scheme. The Missoula City-County Health Department and MWC agreed to defer implementation of the WHPO until after the emplacement of a county-wide Water Quality Protection District which is expected to be created in early 1993. It would then be the responsibility of the Water Quality District to implement and administer WHP in the Missoula Valley. The potential for WHP to become a reality in Missoula now rests with local government agencies and, ultimately, with the general public.

POLSON WELLHEAD PROTECTION AREA

A summary of the Polson project was not available for the draft plan. It will be included in the final document.

APPENDIX B

GOVERNOR'S LETTER

State of Montana
Office of the Governor
Helena, Montana 59620
406-444-3111

TED SCHWINDEN
GOVERNOR

July 21, 1987

Mr. James J. Scherer
Regional Administrator
Environmental Protection Agency
Region VIII
999 18th Street, Suite 500
Denver, Colorado 80202-2405

Dear Mr. Scherer:

In response to your letter of June 23rd, I designate the Montana Department of Health and Environmental Sciences as the agency responsible for implementing the wellhead protection program.

Please contact the Department Director, Dr. John Drynan, to initiate discussions.

Sincerely,

TED SCHWINDEN
Governor

cc: Dr. John Drynan

rcc: John Amigo

APPENDIX C

PUBLIC AWARENESS AND EDUCATION ACTION PLAN

PUBLIC AWARENESS AND EDUCATION ACTION PLAN
WELLHEAD PROTECTION PROGRAM

ACTIVITY	TASK	DONE DATE
MEDIA:		
Establish a data base of information on wellhead protection and associated issues.	Create data base	7-91
	Update data base	AN
Assemble a slide show for introducing the requirements for a wellhead protection area designation.	Collect or reproduce action slides to augment EPA slides.	3-92
	Write script	5-92
Collect WHP videos and distribute to schools, TV stations, and local groups.	Get copies in AV library in Office of Public Instruction, & libraries & TV stations in communities starting a WHP program	8-91 AN
	Arrange to copy videos	AN
Appear on radio and TV call in and talk shows to promote groundwater protection	Compile a list of such shows around the state	4-92
	Contact show host to arrange appearance	AN
Provide TV and radio stations in communities starting WHP programs with PSAs	Create and make copies of appropriate PSAs	8-92
	Distribute to stations	AN

DISPLAYS:

Provide a display of EPA documents for libraries in communities starting WHP program	Obtain materials for portable display	4-92
	Create portable display	5-92
	Arrange for a set of documents for libraries	AN
	Contact librarian & to set up display and add documents to collection	AN
Provide a display for public gatherings such as conventions and fairs	Create a wellhead protection section for a Water Quality Bureau display booth	1-92

NEWSPAPERS, NEWSLETTERS & MAGAZINES:

Provide news releases to local papers and AP describing progress of wellhead protection	Prepare a set of news releases appropriate for each phase of development and implementation of local WHP plans	8-92
	Make personal contact with reporters on local newspapers	11-91
Provide feature articles for Sunday supplements, trade journals, local interest magazines	Prepare a list of publications targeted for such articles and publishing deadlines	9-91
	Prepare at least one article per year	AN
	Create historical file of published articles, hard copy & computer disk	1-92
Supply articles for the groundwater section of the Water Column and other newsletters	Prepare logo for new section	7-91
	Write articles	AN

YOUTH GROUPS:		
Encourage scouting, 4H groups, & other youth groups to establish groundwater protection activities	Help clubs establish badges and projects for groundwater	94
	Encourage clubs to do public awareness projects for groundwater protection	93
Establish contests to encourage participation in WHP	Set up poster, logo, essay, PSA, speech, etc contests with prizes at least one per year	93
PUBLICATIONS:		
Have available a brief description of aquifer protection	Create a poster	2-92
	Place posters in public establishments	AN
	Create & print a brochure	11-91
	Compile a list of mailings that could carry brochure	12-91
	Begin distribution	1-92
Have available a longer public education document that is compelling to read	Create "The Courtship of Purity Wells" an allegory on community involvement in creating and implementing a WHP plan	12-92
	Modify into comic book form for youngsters	93
	Modify into play and/or video production	93
Have available a document designed for children	Create cartoon character, Captain Wellhead	93
	Distribute cartoon strip for education newsletters	93
	Publish comic book or coloring book	94
	Design bumper stickers	93

PUBLIC HEARINGS:

Public meetings or hearings to explain development of statewide wellhead protection plan	Plan and set up meeting locations around the state	5-92
	Publicize	6-92
	Hold meetings	7-92
Public meetings or hearings to explain development of local wellhead protection plans	Plan and set up meeting locations in local area	AN
	Publicize	AN
	Hold Meetings	AN

PUBLIC APPEARANCES:

Provides speakers for conferences, workshops, school classes, service organizations, etc.	Compile list of targeted groups in communities who are starting WHP programs: contact persons, and meeting dates	AN
	Coordinate appearances with other scheduled travel	AN
	Compile list of professional organizations who have annual meetings	10-91

TRAINING SEMINARS

Provide training for community volunteers in locating and inventorying potential sources of contamination.	Establish curriculum for seminar.	9-91
	Set training dates	AN
	Hold seminars	AN

SURVEYS & QUESTIONNAIRES

Obtain information on level of public awareness of WHP and find out public preferences on issues affected by WHP.	Design survey questions	11-92
	Determine best vehicle to reach desired population	12-92
	Include survey in property tax statements, power bills, water rights correspondence, or newspaper.	2-93

INTERDISCIPLINARY SCHOOL WELLHEAD PROTECTION PROJECTS:

Set up demonstration projects in the schools which are public water supplies. These would be interdisciplinary projects involving several classes and the community. Videos would be produced to encourage other schools to begin programs.	Arrange for grant funds and publicize availability.	8-91
	Evaluate grant applications and select schools.	2-92
	Issue contracts.	5-92
	Demonstration project videos complete.	7-93

APPENDIX D

VULNERABILITY ASSESSMENT FORMS

VOLATILE ORGANIC CHEMICALS (VOC)/(SOC) ASSESSMENT REPORT

Date of Inspection: PWS#:

Name of Public Water System:

Owner: Phone:

Address:

City: State: Zip:

Population Served:

Description of Source(s):

Location of Source: Latitude Longitude

Source Designation:

Well Depth:

Purge Time:

Samples Taken:

Time:

Note any sampling problems:

Yes No

Comments:

Evaluation performed by: Signature Title Date

Note: Attach USGS map with:

1) Location of water source
2) All identified sources of contamination
3) Recharge area and radius of influence (if sufficient hydrogeologic data is available)
4) Direction of groundwater flow (if sufficient hydrogeologic data is available)

VULNERABILITY INDEX FOR SYNTHETIC AND VOLATILE ORGANIC CHEMICALS

LOCALLY KNOWN HAZARDS	Index Points
( ) Chemical analysis of regulated VOC/SOC detected in water supply (50 points)	
( ) Chemical analysis of unregulated VOC/SOC detected in water supply (20 points)	
( ) Documented significant VOC/SOC spill in last year (15 points)	
( ) Documented significant VOC/SOC spill more than one year ago (10 points)	
POTENTIAL SOURCES OF CONTAMINATION	
( ) CERCLA, RCRA, or LUST site within 2500 feet of supply well or gallery (15 points)	
( ) Use, disposal, or storage of VOC or SOC within 2500 feet of supply well of gallery (10 points)	
( ) Total number of CERCLA, RCRA, or LUST sites within metropolitan area (1 point per site)	
WATERSHED PROTECTION	
( ) Unprotected (15 points)	
( ) Restricted access to new industry (7 points)	
( ) Restrict access to new industry, agriculture, transportation, and public (3 points)	

VULNERABILITY INDEX FOR SYNTHETIC AND VOLATILE ORGANIC CHEMICALS

INTAKE STRUCTURE — Index Points

( ) Infiltration gallery (10 points) . . . . . .

Static Water Depths and Well Construction

( ) 0 to 100 (ft) (10 points) . . . . . .

( ) 100 to 200 (ft) (7 points) . . . . . .

( ) 200 to 500 (ft) (3 points) . . . . . .

( ) over 500 (ft) (0 points) . . . . . .

( ) Vulnerable well construction (10 points) . . . . . .

MISCELLANEOUS

( ) Stream nearby or irrigation ditch (5 points) . . . . . .

( ) Coarse alluvial, cavernous or highly fractured aquifer (3 points) . . . . . .

POPULATION

( ) 0 to 1,000 (1 point) . . . . . .

( ) 1,001 to 2,000 (2 points) . . . . . .

( ) 2,001 to 3,000 (3 points) . . . . . .

( ) Etc. (1 point per 1,000 people) . . . . . .

VULNERABILITY INDEX . . . . . .

Vulnerability index < 50 = system is "nonvulnerable"
Vulnerability index ≥ 50 = system is "VULNERABLE"

TYPES OF VOC SOURCES

A. Leaky underground storage tanks
B. Other RCRA sources
C. CERCLA sources
D. Other potential sources:
   1. Airports
   2. Aluminum forming industries
   3. Automotive garages
   4. Battery manufacturing plants
   5. Bulk fuel plants
   6. Chemical laboratories
   7. Chemical repackaging industries
   8. Coal mines
   9. Coil coating industries
   10. Copper forming industries
   11. Crude oil pipelines
   12. Dry cleaning plants
   13. Electronic components industries
   14. Foundries
   15. Garages and car repair
   16. Gas stations
   17. Grain storage
   18. Hospitals
   19. Injection disposal wells
   20. Inorganic chemicals industries
   21. Iron and steel industries
   22. Landfills
   23. Leather tanning and finishing plants
   24. Machinery manufacturing plants
   25. Metal finishing and electroplating plants
   26. Military bases
   27. Motor pools
   28. Nonferrous metals industries
   29. Ore mining and dressing plants
   30. Organic chemicals and plastics industries
   31. Paint manufacturing plants
   32. Pesticides industries
   33. Petroleum refineries
   34. Pharmaceuticals manufacturing plants
   35. Porcelain enameling plants
   36. Pulp and paper industries
   37. Refinery product pipelines
   38. Rock quarries
   39. Textile industries
   40. Wood finishing and refinishing industries
   41. Wood preservative industries

APPENDIX E

CONTAMINANT SOURCE INVENTORY

Source Number ____
Public Water Supply Well ____
Inventory Person ____
See Attached Map No. ____

SUGGESTED INVENTORY FORM

A. Occupants Name: _____
B. Site Address: _____
C. City: _____ Zip Code: _____
D. County: _____ T/R/S: _____
E. Phone Number: _____ Lat/Long: _____
Name, Address, and Phone Number of Property Owner if Different From Above: _____

Nature of Property

Residential	____	Commercial	____	Agricultural	____
Industrial	____	City Govt Site	____	Other ( )	____

Potential Sources of Contamination

Circle the potential sources listed below that you have identified at this site. In the space provided, indicate how many.

POTENTIAL SOURCE	QUANTITY	POTENTIAL SOURCE	QUANTITY
Abandoned Water Well	____	Holding Pond/Lagoon	____
Above Ground Storage Tank	____	Injection Well	____
Stormwater Sumps/Ponds	____	Pipelines	____
Animal Feedlot	____	Mine/Quarry	____
Artificial Recharge Projects	____	Municipal Sewage	____
Auto Salvage Yard	____	Oil/Gas Well	____
Irrigated Lawns & Crops	____	Brine Pits	____
Cesspool, Septic Tank, Privie	____	Railroad	____
Chemical Storage Facility	____	Service Station	
Drainage Well/Canal	____	Disposal Well	____
Dump or Landfill	____	Sewage Plant Sludge	
Fertilizer/Pesticide Use	____	Disposal	____
& Mixing/Loading Site	____	Stream (Lake, River, Creek)	____
Land Farm	____	Underground Storage Tank	____
Grain Storage Bin	____	Chemigation Well	____
Highway or Road Frontage	____	Water Well	____
		Other	____

Chemicals Used Or Stored: _____

APPENDIX F

MODEL ORDINANCES

ORDINANCE FOR A SMALL COMMUNITY

SHERIDAN, MONTANA

ORDINANCE NO. - _____

AN ORDINANCE REGULATING ESTABLISHMENTS WHICH THREATEN TO POLLUTE THE WATER SUPPLY OF THE TOWN OF SHERIDAN.

WHEREAS the Town of Sheridan is investing $ 560,190 in Community Development Block Grant Funds and general revenue bonds to construct a new water supply, and

WHEREAS the new water supply consists of wells which draw upon ground water flowing through the aquifer located beneath the town, and

WHEREAS it is necessary to maintain the quality of the ground water in the aquifer in order to protect the health and safety of the residents of Sheridan and to protect the Town's investment in its water supply system, and

WHEREAS any individual, entity or business which threatens the quality of the Town's ground water is an "offensive and unwholesome establishment" as that term is utilized in Section 7-21-4204 MCA, and

WHEREAS the Town is authorized by Section 7-13-4406 and 7-21-4204 MCA to regulate or prohibit such establishments within the Town or within three miles from its limits,

NOW THEREFORE, BE IT ORDAINED by the Town Council of the Town of Sheridan as follows:

Section 1. Definitions

a. "Offensive and unwholesome establishment" shall mean any business, entity, organization or individual or location which manufactures, possesses, disposes, transports, handles, deals with, stores, sells, or allows the presence of pollution under circumstances which pollute or threaten to pollute the ground water supply of the Town of Sheridan.

b. "Pollution" in regard to the water supply for the Town of Sheridan is defined by Section 75-5-103 MCA.

c. "Potentially polluting material" means any substance that would result in pollution of the Town's ground water supply if allowed to enter the supply in sufficient quantities. The term "potentially polluting material" includes but is not limited to the following:

1. sewage effluent, petroleum products, pesticides, and fertilizer; hazardous wastes as defined by Section 75-10-403 MCA;

2. hazardous substances as defined by Section 75-10-602 MCA;

3. hazardous or deleterious substances as defined by Section 75-10-701 MCA;

4. regulated substances as defined by Section 75-10-403 MCA

5. halogenated solvents as defined by Section 75-10-451 MCA;

6. hazardous chemicals as defined by Section 50-78-102 MCA

7. contaminants identified by the U.S. Environmental Protection Agency pursuant to the federal Safe Drinking Water Act (42 USC 300f et seq.)

8. Pollution as defined herein above.

Section 2. Offensive or unwholesome establishments prohibited.

No offensive or unwholesome establishment may exist within the corporate limits of the Town of Sheridan or within three miles thereof except upon application made to and permission received in advance from the Town Council.

Section 3. Pollution and potentially polluting material prohibited.

No pollution nor potentially polluting material may exist within the corporate limits of the Town of Sheridan or within three miles thereof except upon application made to and permission received in advance from the Town Council.

a. Applications for permits shall be made on a form supplied by the Town Clerk. Applications will be considered by the Town Council at the next regularly scheduled meeting after submission to the Town Clerk.

b. No permit shall be issued except in conformity with all State and Federal statutes and regulations and upon conditions imposed by the Town Council to preserve the integrity of the Town's ground water source and water system.

c. Application for a permit and acceptance of a permit shall be consideration for and agreement by the applicant and holder that the Town Council or its representative may inspect the premises of the applicant or the permittee at any time.

Section 4. Public Nuisance

The existence of pollution or potentially polluting materials within the limits of the Town of Sheridan or within three miles thereof without a permit issued by the Town Council under this Ordinance is a Public Nuisance which may enjoined, abated or punished as a criminal offense in accord with the law.

Section 5. Revocation

The Town of Sheridan may revoke any permit previously issued for good cause following notice and an opportunity to be heard. A permit shall be revoked for failure to adhere to conditions required, upon conviction of the permittee of maintaining a public nuisance, or after relief granted in favor of the Town to abate a public nuisance.

PASSED BY THE TOWN COUNCIL and signed after the first reading this _____ day of _____, 1990.

_____
KELLY ELSER, Mayor

ATTEST:

_____
NORMA STEINER, Town Clerk

PASSED BY THE TOWN COUNCIL and signed after the second reading this _____ day of _____, 1990.

_____
KELLY ELSER, Mayor

ATTEST:

_____
NORMA STEINER, Town Clerk

ORDINANCE FOR A METROPOLITAN AREA

MISSOULA, MONTANA

ATTACHMENT A

PUBLIC WATER SUPPLY
WELLHEAD PROTECTION ORDINANCE
(WHPO)

DRAFT

DRAFT

12.22.91

PUBLIC WATER SUPPLY
WELLHEAD PROTECTION ORDINANCE

The Missoula Aquifer was designated by the United States Environmental Protection Agency as a "sole source aquifer" on June 7, 1988, which means it is the only practical source of drinking water for residents in the Missoula Valley. The residents of the City of Missoula and their elected representatives recognize the urgent need to protect existing and future public water supply wells served by the Missoula Aquifer from the adverse effects of bacterial and chemical contamination.

In 1991, private consultants working pursuant to an agreement between the Missoula City/County Health Department and Mountain Water Company completed a report further characterizing the Missoula Aquifer, identifying potential sources of groundwater pollution and identifying potential techniques to reduce the threat of groundwater contamination. This report recommends a comprehensive, multi-phase approach to wellhead protection which will address the multiple potential threats to the Missoula Aquifer.

This Public Water Supply Wellhead Protection Ordinance is one element of this comprehensive approach. This ordinance addresses the storage, handling, use and disposal of potentially hazardous or toxic substances ("Regulated Substances") that may contaminate groundwater. The ordinance prohibits new activities involving Regulated Substances near public water supply wellheads and it regulates activities involving Regulated Substances in areas that serve as principal groundwater recharge areas to public water supply wellheads. Persons engaged in activities involving the storage, handling, use or disposal of Regulated Substances within identified recharge areas will be required to obtain a permit and they will be required to file an inventory of Regulated Substances, develop and implement a management plan prescribing approved methods of handling and disposing of Regulated Substances and develop an emergency plan prescribing procedures to be implemented in the event of a release or threatened release of Regulated Substances.

Authority for this ordinance is granted to the Council of the City of Missoula in accordance with the City's general authority under the Montana Constitution and Montana Code Annotated to establish regulatory programs to protect the health, safety and general welfare of the residents of, and visitors to, the City of Missoula.

DRAFT

12.22.91

PUBLIC WATER SUPPLY
WELLHEAD PROTECTION ORDINANCE

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Authority for this ordinance is granted to the Council of the City of Missoula in accordance with the City's general authority under the Montana Constitution and Montana Code Annotated to establish regulatory programs to protect the health, safety and general welfare of the residents of, and visitors to, the City of Missoula.

NOW THEREFORE BE IT ORDAINED BY THE COUNCIL MEMBERS OF THE CITY OF MISSOULA, MONTANA:

Section 1. SHORT TITLE; APPLICABILITY; CONSTRUCTION.

1.01 This Ordinance will be known as the "Public Water Supply Wellhead Protection Ordinance." The provisions of the Ordinance will be effective within the City of Missoula, Montana and the Mayor of the City is hereby vested with the power to enforce the terms of this Ordinance in all places within five miles outside the city limits pursuant to Title 7, Chapter 4, Section 4306, Montana Code Annotated (1991). This Ordinance will establish prohibitions and restrictions to prevent public water supply contamination by hazardous or toxic substances. This Ordinance shall be liberally construed to effect its purposes.

Section 2. LEGISLATIVE INTENT.

2.01 In order to properly protect existing and future water supply wells serving the City of Missoula, the Missoula City Council declares that the storage, handling, use, production or disposal of hazardous or toxic substances in the Zone of Contribution to public water supply wells is potentially harmful to the drinking water of the City of Missoula and that certain activities involving hazardous or toxic substances are prohibited and regulated within certain defined Wellhead Protection Areas.

Section 3. DEFINITIONS

3.01 The following definitions apply within this Ordinance:

Administering Agency - The agency or department charged by the Missoula City Council with administering and enforcing this Ordinance and its accompanying regulations.

Aquifer - A groundwater bearing geologic formation, or formations, that contain enough saturated, permeable material to yield significant quantities of water.

Contamination - The presence of any harmful or deleterious substances in the water supply.

Continuous Transit - The nonstop movement of a mobile vehicle.

Drinking Water - Water that is satisfactory for drinking, for culinary and domestic purposes, and that meets current state and federal drinking water standards.

EPA - United States Environmental Protection Agency.

Facility - An area, a building or buildings, appurtenant structures or surrounding land are used by a person.

Groundwater - Water that fills all the unblocked pores of underlying material below the water table which is the upper limit of saturation, or water which is held in the unsaturated zone by capillarity.

Handle - To use, generate, process, produce, package, treat, store, emit, discharge or dispose of a Regulated Substance. "Handle" includes the transportation of a Regulated Substance within the city limits other than continuous transit.

Missoula Aquifer - The aquifer underlying the Missoula Valley which supplies the area with water.

Person - Any natural person, individual, public or private corporation, firm, association, joint venture, partnership, municipality, governmental agency, political subdivision, public officer or any other entity whatsoever or any combination of such, jointly or severally.

Pollution - The presence of any substance (organic, inorganic, radiological or biological) or condition (temperature, PH, turbidity) in water which tends to degrade its quality so as to constitute a hazard or impair the usefulness of the water.

Primary Container - A container or storage device which comes into immediate contact on its inner surface with a substance or material.

Public Water System - Any privately owned, municipally owned or county owned system providing water service to the public that is designed to serve or serves ten or more families or 25 or more persons daily or has at least ten service connections at least sixty days out of the calender year.

Regulated Substances - A hazardous or toxic substance regulated under Section 5 of this Ordinance.

Secondary Containment - Containment external to and separate from the primary container and designed to prevent release into the subsurface environment of any spilled material.

Spill - Any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping or disposing of a solid or liquid into the environment.

Well - A pit or hole sunk into the earth to reach a resource supply such

as water.

Wellhead - The physical structure, facility or device at the land surface from or through which groundwater flows or is pumped from subsurface, water-bearing formations.

Wellhead Protection Area (WHPA) - The surface and subsurface area surrounding a water well or well field supplying a public water system, through which contaminants are reasonably likely to move toward and reach such water well or well field.

Zones of Contribution (ZOC) - The area surrounding a pumping well that encompasses all areas or features that supply groundwater recharge to the well.

Section 4. MAPS OF WELLHEAD PROTECTION AREAS

4.01 The Wellhead Protection Area (WHPA) maps completed in 1991 are incorporated and made a part of this Ordinance. WHPAs have been delineated by scientifically established criteria relating to the physical characteristics of the Missoula Aquifer and to the transport gradients caused by either natural forces or the induced pumpage of wells. WHPA boundaries have then been established to reflect political and geographic boundaries. These maps will be on file and will be maintained by the Administering Agency. Any amendments, additions or deletions to the maps must be approved by the Missoula City Council following a public hearing. The maps will be provided to the Office of Community Development, the City Public Works Department and any other agency requesting them.

4.02 The WHPA maps may be periodically updated in accordance with the provisions of this Ordinance. The basis for such an update may include, but is not limited to the following:

a) Changes in the technical knowledge concerning the Missoula Aquifer.

b) Changes in the pumping rate of the wells.

c) Reconfiguration of the wellheads.

d) Designation of new wellheads.

4.03 The WHPAs indicated on the maps are as follows:

a) Zone 1: There are two types of areas identified as Zone 1:

1) Critical WHPA: This zone includes a portion of the ZOC

immediately surrounding the wellhead extending approximately 1000 feet in the upgradient groundwater flow direction and an approximate 200 foot buffer zone extending from the ZOC's lateral and downgradient borders.

2) Multiple Well Recharge WHPA: This zone includes an area near the west end of Hellgate Canyon which serves as a zone of contribution for many of the public water system supply wells within the City.

b) Zone 2 (the Primary WHPA): This zone includes the entire ZOCs to all public water system supply wells including a buffer of several hundred feet.

c) Zone 3 (the Peripheral WHPA): The zone consists of adjacent upland areas which contribute groundwater and surface water to Zone 2.

Section 5. REGULATED SUBSTANCES

5.01 The substances to be regulated include certain known hazardous or toxic substances (referred to in this document as Regulated Substances) which may cause contamination of the Missoula Aquifer.

5.02 The substances to be regulated are those set forth on, or referred to in, the list entitled WELLHEAD PROTECTION -- REGULATED SUBSTANCES, which is attached to this document as Exhibit "A." The list will be reviewed annually and revised from time to time as necessary by formal amendment of the Ordinance. A mixture shall be deemed a Regulated Substance if it contains [any] [more than one percent by volume of any] Regulated Substance.

5.03 This Ordinance shall not apply to Regulated Substances contained in:

a) consumer products packaged for distribution to, and use by, the general public for personal, family or household purposes;

b) commercial products used at a facility solely for janitorial purposes;

c) commercial office supplies in a business that does not engage in commercial printing or reproduction;

d) food, drugs or cosmetics;

e) materials present as a solid inside a manufactured item; or

f) a vehicle fuel tank.

Section 6. RESTRICTIONS WITHIN WELLHEAD PROTECTION AREAS

6.01 Zone 1: Any person who engages in an activity involving the handling of Regulated Substances within a Zone 1 on the date on which that Zone 1 is established, either pursuant to the initial adoption of this Ordinance or the subsequent updating of the WHPA maps, may continue to do so only after obtaining a Wellhead Protection Operating Permit. Such continuing activity shall be referred to as a "legal noncomplying activity." No person shall engage in any new activity involving the handling of Regulated Substances within a Zone 1.

a) Any legal noncomplying activity may be continued and maintained so long as the person engaged in the legal noncomplying activity maintains a Wellhead Operating Permit, subject to the following conditions:

1) No legal noncomplying activity may be enlarged or increased or expanded or altered so as to substantially increase the risk of contamination from such activity in the judgment of the Administering Agency.

2) Any legal noncomplying activity that is discontinued or abandoned or ceases for a period of six months shall not be considered a legal noncomplying activity, and thereafter may not be resumed.

3) In the event a facility which houses a legal noncomplying activity is destroyed or damaged by any means to an extent that the cost of repair is more than fifty percent of the cost to replace the facility in which the activity is located (as determined by the City building inspector), the activity involving the handling of Regulated Substances shall not thereafter be considered a legal noncomplying activity and may not thereafter be resumed or continued.

6.02 Zone 2: Unless exempt under the terms of this Ordinance, those persons who engage in activities within a Zone 2 involving the handling of Regulated Substances may do so only after obtaining a Wellhead Protection Operating Permit.

6.03 Zone 3: Any person who engages in an activity involving the handling of Regulated Substances in Zone 3 shall not be required to obtain a Wellhead Operating Permit but shall comply with the Regulated Substances Inventory requirements in Section 8 and the Reporting of Spills requirements in Section 12 of the Ordinance.

Section 7. PERMITS REQUIRED

7.01 Wellhead Protection Operating Permits

a) Zone 1 -- All persons required to obtain a Wellhead Protection Operating Permit within a Zone 1 shall obtain that permit within one year after that Zone 1 is established either pursuant to the initial adoption of this Ordinance or the subsequent updating of the WHPA maps.

b) Zone 2 -- All persons who engage in an activity involving the handling of Regulated Substances within a Zone 2 on the date on which that Zone 2 is established, either pursuant to the initial adoption of this Ordinance or the subsequent updating of the WHPA maps, shall obtain a Wellhead Protection Operating Permit within not more than four years after that Zone 2 is established. The Administering Agency is authorized to prepare a list of facilities which it believes require a Permit under this Subsection. The list shall be prioritized to establish deadlines for these facilities to obtain Wellhead Protection Operating Permits ranging from not less than 2 to not more than 4 years after the date that Zone 2 is established. The list priorities shall be based upon the Administering Agency's estimate of the potential contamination hazard posed by each facility. Within a Zone 2 no person may commence any new activity involving the handling of Regulated Substances after the date on which that Zone 2 is established until a Wellhead Protection Operating Permit has been issued.

c) Duration of Permits -- A Wellhead Protection Operating Permit must be renewed every two years, with permits for facilities with even-numbered street addresses expiring in even-numbered years and permits for facilities with odd-numbered addresses expiring in odd-numbered years. Initial permits for facilities with odd[even] numbered addresses shall be valid for three years.

7.02 Wellhead Protection Operating Permit Applications -- All applications for a Wellhead Protection Operating Permit must be filed in complete form with the Administering Agency at least 120 days prior to the deadline for obtaining an initial permit or expiration of an existing Permit. All applications shall include the following:

a) A completed Wellhead Protection Operating Permit Application Form, which shall be available from the Administering Agency.

b) A Regulated Substances Inventory, as set forth in Section 8.

c) A Regulated Substances Management Plan, as set forth in Section 9.

d) An Emergency Preparedness Plan, as set forth in Section 12.

e) Such other information or submittals as the Administering Agency may request.

Any person required to file documents relating to Regulated Substances with any federal, state or other local agency may utilize those documents as part of the Permit submittal if they include substantially the same information as required for the Wellhead Protection Operating Permit, provided those documents are attached to the appropriate plan or submittal and the plan or submittal incorporates the material by reference in a clear and specific manner.

7.03 Wellhead Protection Operating Permit Issuance

a) The Permit application and required submittals shall be reviewed by the Administering Agency for completeness.

b) If the Permit application and required submittals are not complete, the Administering Agency shall notify the applicant in writing of the deficiencies and the applicant shall have 45 days within which to cure the deficiencies.

c) The Administering Agency shall issue a Wellhead Protection Operating Permit upon a finding that:

1) The Permit application and required submittals are complete;

2) Any physical improvements or facility modifications required by any of the required submittals have been completed; and

3) All fees for the Wellhead Protection Operating Permit have been paid.

d) The Wellhead Protection Operating Permit shall authorize the applicant to handle Regulated Substances identified in the application in quantities not to exceed those identified in the Regulated Substances Inventory and in a manner consistent with the Regulated Substances Management Plan for the facility. The Wellhead Protection Operating Permit shall authorize an agent of the City to enter and inspect the facility subject to the Permit.

7.04 Wellhead Protection Operating Permit Amendment -- A written application to amend a Wellhead Protection Operating Permit shall be filed with the Administering Agency at least 30 days prior to any of the following:

a) the addition of Regulated Substances to the Regulated Substances

Inventory;

b) an increase of 25% or more in the quantity of any Regulated Substances on the Regulated Substances Inventory; or

c) any substantive change in either the Regulated Substances Management Plan or the Emergency Preparedness Plan.

7.05 Wellhead Protection Operating Permit Renewal -- To renew a Wellhead Protection Operating Permit the applicant shall submit all documentation required for the initial Permit application. The application to renew a Permit shall be filed at least 120 days prior to the expiration date of the existing Permit.

7.06 Transfer or Assignment of Wellhead Protection Operating Permits -- The Administering Agency must be notified at least 30 days before a change in ownership of the facility or activity subject to a Wellhead Protection Operating Permit.

7.07 Closure Permits -- After the effective date of this Ordinance, any person permanently terminating an activity regulated by this Ordinance or discontinuing the activity regulated by this Ordinance for a period exceeding six months must remove all Regulated Substances from the ~~site~~ facility. Before the closure takes place, such person must obtain an activity Closure Permit.

7.08 Closure Permit Requirements -- All applications for a Closure Permit must provide the following information:

a) A schedule of events to complete the closure. This must include an appointment with the Administering Agency to inspect the facility.

b) A written record identifying the Regulated Substances (and the quantity of each) at the facility on the date on which handling terminated, and description of the off-site disposition of all such Regulated Substances.

7.09 Fee Schedule for Permits -- The Administering Agency shall establish fees for each of the following activities, calculated to cover the administrative costs incurred by the Administering Agency in implementing this Ordinance:

a) Filing Fee -- A nonrefundable fee to be paid before a Wellhead Protection Operating Permit application is accepted for review. This will be a uniform fee for all applications and it will be applied against the Wellhead Protection Operating Permit fee.

b) Wellhead Protection Operating Permit Fee -- A fee to be paid

before a Wellhead Protection Operating Permit may be issued or renewed. This fee may vary based upon a schedule to be adopted by the Administering Agency from time to time taking into account the complexity of the application information and the risk of contamination posed by the facility.

c) Wellhead Protection Operating Permit Amendment Fee -- A uniform fee for all applications to amend a Wellhead Protection Operating Permit.

d) Closure Permit Fee -- A fee to be paid before a Closure Permit may be issued. This fee may vary based upon a schedule to be adopted by the Administering Agency from time to time taking into account the complexity of the closure application and the risk of contamination posed by the facility.

e) Permit Transfer Fee -- A fee to be paid to the Administering Agency upon a change in ownership of a facility or activity subject to a Wellhead Protection Operating Permit. This shall be a uniform fee for all facilities.

f) Late Fee -- The Administering Agency shall establish a late fee to be assessed whenever a permit or renewal application is filed after the appropriate deadline.

Section 8. REGULATED SUBSTANCES INVENTORY

8.01 Required Inventory -- Unless exempt under the terms of this Ordinance, any person handling Regulated Substances within a Zone 1, 2 or 3 must file a Regulated Substances Inventory with the Administering Agency. The initial Inventory must be filed by persons within Zones 1 or 2 no later than the date on which such person must file an initial application for a Wellhead Protection Operating Permit. The initial Inventory must be filed by persons within Zone 3 no later than December 31, 1995.

8.03 Inventory Updates -- Persons within Zones 1 or 2 shall file an updated Inventory in connection with their application to renew their Wellhead Protection Operating Permit. Persons within Zone 3 shall file an updated Inventory by December 31 of each odd-numbered year or whenever there is an addition of Regulated Substances to the Inventory or there is an increase of 25% or more in the quantity of any Regulated Substances on the Inventory.

8.04 Inventory Contents -- The Inventory shall be prepared on a form provided by the Administering Agency. The Inventory shall identify each Regulated Substance handled at the facility by its chemical or common name, CAS and UN numbers (if known), physical state (solid, liquid or gas), and indicate the maximum quantity handled at the facility at any one

time. Any applicable material safety data sheets (MSDS) shall be submitted with the Inventory.

8.05 Confidentiality -- The Regulated Substances Inventory shall be a public document available for public inspection during regular business hours, subject to such provisions for confidentiality as shall be negotiated between the City and the filing party to protect proprietary or trade secret information.

Section 9 REGULATED SUBSTANCES MANAGEMENT PLAN

9.01 Required Regulated Substances Management Plan -- Unless exempt under the terms of this Ordinance, any person handling Regulated Substances within a Zone 1 or 2 must file a Regulated Substances Management Plan ("RSMP") with the Administering Agency. The initial RSMP must be filed no later than the date on which such person must file an initial application for a Wellhead Protection Operating Permit. An updated RSMP shall be filed in connection with each application to renew a Wellhead Protection Operating Permit or whenever there is any substantive change in the implementation or operation of a RSMP at the facility.

9.02 RSMP Contents -- The RSMP shall contain the following:

a) The name and address of the facility; business phone number; the name and title of the person(s) responsible for implementing the RSMP; hours of operation; principle business activity; and SIC code.

b) For each Regulated Substance that is handled at the facility, the RSMP shall describe:

1) The state (solid, liquid or gas), quantity and type of container in which each Regulated Substance is acquired by the facility;

2) The manner and conditions under which each Regulated Substance is stored and transferred prior to use or disposition;

3) The manner and conditions under which each Regulated Substance is used at the facility;

4) The manner and process by which any waste Regulated Substances are treated, recycled or disposed;

5) The physical facilities and operational requirements employed at the facility to ensure that Regulated

Substances do not spill or otherwise cause contamination during transportation, transfer, use and disposal. The RSMP shall provide for suitable precautions to reduce the potential for Regulated Substances to spill or otherwise cause contamination, including, if appropriate, secondary containment and methods to ensure separation and protection of Regulated Substances from conditions which may cause a fire or explosion or other release.

6) For each Regulated Substance handled at the facility, the RSMP shall discuss reasonably available alternatives by which the facility could:

(a) Substitute materials not on the list of Regulated Substances;

(b) Reduce the quantity of Regulated Substances handled by process changes, reuse or recycling; and

(c) Adopt handling practices or make physical improvements to reduce the potential for contamination.

Section 10. EMERGENCY PREPAREDNESS PLAN

10.01 Required Regulated Substances Management Plan -- Unless exempt under the terms of this Ordinance, any person handling Regulated Substances within a Zone 1 or 2 must file an Emergency Preparedness Plan ("EPP") with the Administering Agency. The initial EPP must be filed no later than the date on which such person must file an initial application for a Wellhead Protection Operating Permit. An updated EPP must be filed in connection with each application to renew a Wellhead Protection Operating Permit or whenever there is any substantive change in the implementation or operation of an EPP at the facility.

10.02 EPP Contents -- The EPP shall contain the following:

a) The name and address of the facility; business phone number; the name, titles and emergency phone numbers of the primary response person and at least one alternate; hours of operation; principle business activity and SIC code.

b) A plat for the facility at a legible scale showing the following:

1) the location of all buildings and improvements as they relate to Regulated Substances, including points of actual or potential loading, transfer, storage, use and disposal;

2) the location of all equipment used for monitoring or

responding to releases of Regulated Substances;

3) uses and structures on all adjoining properties;

4) any information which indicates the pathway which might be taken by a potential release, including but not limited to information on the location of sewer manholes or wells, drainage ditches, nearby streams, rivers or irrigation ditches, and the direction of surface drainage.

c) A description of emergency equipment available at the facility and written procedures describing how such equipment will be inspected and maintained.

d) Identification of the individual(s) responsible for monitoring releases and threatened releases and a description of the steps to be taken to monitor releases and threatened releases, and the procedures to be followed to immediately report a release or threatened release to the Administering Agency, the City Fire Department and any other entity required by law.

e) A description of procedures to control, mitigate and/or remediate any release in order to minimize any potential contamination.

10.03 EPP Training -- The EPP must describe procedures for, and each person responsible for submitting an EPP must provide, training to all employees who handle Regulated Substances. The training must ensure that employees are familiar with the recommended handling, safety and emergency response procedures for Regulated Substances.

Section 11. UNDERGROUND STORAGE TANKS AND LINES

11.01 New Underground Storage Tanks and Lines -- All new or replacement underground storage tanks and lines installed within a Zone 2 after the effective date of this Ordinance and all replacement underground storage tanks and lines installed within a Zone 1 after the effective date of this Ordinance shall have release detection equipment installed as provided by A.R.M. 16.45.403 (1991) of the Montana Underground Storage Tank Regulations, as the same may be amended from time to time. Monitoring devices must be installed in the secondary containment space to detect release and failures of the primary container. The owner must monitor for leaks monthly and maintain records of monitoring for two years. Other methods of leak detection may be approved by the Administering Agency if such alternate methods meet the intent of this Section and comply with the Montana Underground Storage Tank Regulations.

Section 12. REPORTING OF SPILLS

12.01 Reporting of Spills --Any spill of a Regulated Substance in an amount

greater than that indicated in Exhibit "A" shall be reported to the Administering Agency by telephone immediately. A full written report, including a description of the steps taken to contain and mitigate the spill shall be submitted to the Administering Agency within 15 days of discovery of the spill.

Section 13. GROUNDWATER MONITORING

13.01 Monitoring for Regulated Substances in Groundwater Monitoring Wells -- In addition to the Wellhead Protection Operating Permit requirements set forth in Section 7, one or more groundwater monitoring wells may be required by the Administering Agency if there is reasonable justification to suspect a high potential for a release of Regulated Substances from a facility into the environment. Monitoring wells will be installed at the expense of the permit holder and the permit holder will be required to perform periodic monitoring at its expense. Substances to be monitored and the frequency of monitoring shall be established by the Administering Agency. Certified analytical results of monitoring shall be submitted directly to the Administering Agency from the analytical laboratory.

Section 14. PROTECTION OF EXISTING AND FUTURE WELLHEADS

14.01 Existing wellheads for public water system supply wells shall comply with the following design standards within one year after the effective date of the Ordinance:

a) Security fences at least six feet in height shall surround the wellhead and enclose all above-ground structures and appurtenances related to the wellhead.

b) All water courses and open sumps within 100 feet of the wellhead shall be closed or sealed from surface water infiltration into the ground.

c) Prohibit any handling of Regulated Substances within the fenced compound, except for Regulated Substances that may be used for the disinfection or treatment of pumped water.

d) Permit the inspection by the Administering Agency as provided in Section 18 of this Ordinance.

14.02 Wellheads for public water system supply wells installed after the effective date of this Ordinance shall comply with the following standards:

a) All of the requirements for existing wellheads as specified in Section 14.01 of this Ordinance.

b) New wells must be installed within design standards established by

the Board of Water Well Contractors, Title 37, Chapter 43, MCA and Title 36, Chapter 21, ARM.

c) Development rights of a 100 foot radius around the wellhead shall be secured by the water purveyor of the public water supply well and no Regulated Substances may be present within this secured area.

Section 15. WELLHEAD PROTECTION ENFORCEMENT

15.01 The Administering Agency is authorized to adopt regulations as necessary to implement the Ordinance and the Administering Agency will have the power and authority to administer and enforce the provisions of this Ordinance and the adopted regulations.

15.02 The Administering Agency shall designate a Wellhead Protection Officer within the Administering Agency to supervise the implementation and enforcement of this Ordinance and any adopted regulations. The appointee will be an environmental health professional with experience and knowledge in hydrogeology. In making the appointment, the Administering Agency must consider the applicant's qualifications and experience in the field of environmental quality control.

15.03 The Wellhead Protection Officer will designate inspectors as needed to enforce this Ordinance and any adopted regulations. These inspectors will have all necessary powers and authority of enforcement.

Section 16. ADMINISTRATIVE DUTIES OF THE ADMINISTERING AGENCY

16.01 The Administering Agency will:

a) To the extent consistent with this Ordinance, coordinate the requirements and impositions of this Ordinance with other environmental, safety and health ordinances of the City and the Missoula City/County Health Department. The Administering Agency shall recommend to the City Council amendments to this Ordinance to further such coordination, eliminate duplication of effort and reduce the burden on regulated persons.

b) Recommend amendments to the provisions of this Ordinance for adoption by the City Council.

c) Make continuing studies and periodic reports and recommendations for the improvement of wellhead protection controls throughout the City and area of extraterritorial jurisdiction. The Administering Agency will also work in cooperation with federal, state and local agencies and groups interested in the field of wellhead protection.

d) Recommend revisions and updates to the list of Regulated Substances and to the Wellhead Protection Area maps.

e) Investigate wellhead protection programs and activities that are in operation in other areas and make recommendations for improvements to the regulation, administration and enforcement of Missoula's wellhead protection.

f) Publicize the importance of adequate wellhead protection, participate in public hearings, discussions, forums and institutes; and arrange programs to present information by experts in the field of wellhead protection. These activities are subject to budget limitations.

g) Perform duties related to wellhead protection that may be assigned form time to time by the Missoula City Council.

h) The Administering Agency and the Missoula City Council shall review this Ordinance five years from its effective date to ensure that the regulations meet the Ordinance's intent and purpose.

Section 17. IMPLEMENTATION DUTIES AND POWERS OF THE ADMINISTERING AGENCY

17.01 The Administering Agency will:

a) Implement and enforce the provisions of this Ordinance and any adopted regulations.

b) Investigate alleged infractions of this Ordinance and of any adopted regulations.

c) Make appropriate surveys, tests and inspections of property, facilities, equipment and processes operating under the provisions of this Ordinance and any adopted regulations.

d) Maintain, review and supervise all plans, reports and operating records that persons are required to file in order to operate facilities subject to the provisions of this Ordinance.

e) Establish technical guidelines and criteria for permitting requirements.

f) Give all possible assistance to those persons operating facilities and processes which can endanger the wellheads. The Administering Agency will not, however, design equipment or facilities.

g) Cooperate with and assist the federal, state and local agencies to help protect the wellheads.

Section 18. INSPECTIONS

18.01 Agents of the City of Missoula are authorized to enter and inspect at reasonable hours all facilities within the Wellhead Protection Areas in which the Administering Agency reasonably believes may handle Regulated Substances in order to determine that the provisions of this Ordinance and the regulations relating to wellhead protection are being followed.

18.02 If a person with common authority over a facility will not permit an inspection, the inspection will be rescheduled, and the person will receive notice of the inspection by U.S. certified mail. If this person refuses the second inspection, a court of competent jurisdiction will have probable cause to issue an administrative warrant to inspect, survey or examine the facility.

18.03 If a facility appears vacant or abandoned, and the property owner cannot be readily contacted to obtain consent for an inspection, an agent of the City may enter any open or unsecured portion of the facility to conduct an inspection.

18.04 Agents of the City will be provided with official identification and will show their identification when making an inspection.

18.05 Law enforcement officers must assist in making inspections when the agent of the City requests their assistance.

Section 19. NOTICE OF VIOLATION, NOTICE OF HEARING, AND HEARING PROCEDURE

19.01 When the Wellhead Protection Officer or an Inspector determines that there is a violation of this ordinance or any adopted regulations, the Officer or Inspector will give notice as follows:

a) A notice of violation will:

1) Be in writing;
2) Be dated and signed by the Wellhead Protection Officer or Inspector;
3) Specify the violation or violations;
4) State in the Notice of Violation that the violation(s) must be corrected by a specified date;
5) State that if the violation is not corrected by the said specified date, the Wellhead Protection Officer may request a hearing before the Administering Agency within thirty days from the date specified in the Notice of Violation.

19.02 The Administering Agency will consider violations of this Ordinance and of any adopted regulations.

19.03 If the alleged violator does not comply by the date specified in the Notice of Violation, the Wellhead Protection Officer may schedule a hearing before the Administering Agency.

19.04 The alleged violator and property owner will have a Notice of Hearing served on them by personal service or certified mail (return receipt requested) no less than 10 days prior to the hearing. The above time frame will begin from the date of the mailing or the personal service of the notice. If the owner or responsible person is not present or is avoiding service of the Notice of Hearing, the notice will be posted in a conspicuous place at the facility where the alleged violation exists.

19.05 A Notice of Hearing will contain the following information:

a) Name and address of the alleged violator and property owner (if different);

b) Description of the facility causing the violation;

c) Location of the violation;

d) Ordinance section or regulation section alleged to have been violated and the specific violation;

e) Time, date and place of the hearing;

f) The signature of the Wellhead Protection Officer:

g) A statement that says, "Failure to attend may result in an order being issued that will be adverse to your interests:"

h) That all parties may be represented by counsel; and

i) That all parties will be given an opportunity to present witnesses and evidence in support of their position.

19.06 Hearing Procedure

a) All testimony will be under oath and will be recorded.

b) Assuming that proper notice of the hearing was served, as was provided in Section 19.04, a hearing may proceed in the absence of the alleged violator.

c) All hearings will be conducted, if feasible, according to the

Montana Rules of Civil Procedure and the Montana Evidence Code. However, the general nature of the hearing will be informal.

d) Documentary evidence may be received in the form of a copy or excerpt if the original is not readily available.

e) A party will be permitted to conduct cross-examination when testimony is taken or when documents are made a part of the record.

f) The rules of privilege will be effective to the same extent that they are now or that they may be when recognized in future civil actions.

g) Each party will have the following rights:

1) To be represented by counsel;
2) To call and examine witnesses;
3) To introduce exhibits;
4) To cross-examine opposing witnesses on any relevant matter, even though the matter was not covered under direct examination;
5) To impeach any witness regardless of which party first called him or her to testify;
6) To rebut the evidence

h) The Administering Agency may allow any interested person who makes an application and can show good cause to intervene and appear in a proceeding pending before the Administering Agency.

Section 20. ORDERS OF THE ADMINISTERING AGENCY

20.01 After due public hearing, the Administering Agency will issue an order based on the greater weight of the evidence. If the Administering Agency finds a violation of this Ordinance, the Administering Agency will issue an order revoking the Wellhead Protection Operating Permit, require the party to obtain a permit, or any other remedy deemed necessary. However, the Administering Agency may grant an additional period of time to remedy violations prior to issuing a final order. All orders will be in writing, signed and dated by the Administering Agency, and will contain findings of fact and conclusions of law supporting the order.

20.02 At the conclusion of the hearing, if the Administering Agency finds no violation, it will state this and issue an order dismissing the complaint.

20.03 An order, decision or opinion of the Administering Agency may be appealed within the time period prescribed by general law by any party receiving an adverse ruling. The appeal of an Administering Agency decision will be made to the City Council.

Section 21. INJUNCTIVE RELIEF

21.01 If a person continues to operate a facility or engage in a activity in violation of the provisions of this Ordinance or its accompanying regulations, then the City of Missoula may file an action for injunctive relief in the District Court for Missoula County.

Section 22. PENALTIES

22.01 Any person convicted of violating any provision of this Ordinance will be punished by a fine not to exceed five hundred dollars for each offense, or by imprisonment in the County jail not to exceed sixty days, or by both such fine and imprisonment. Each day that a violation is permitted to exist shall constitute a separate offense.

Section 23. SEVERABILITY

23.01 If any section, sentence, clause or phrase of this ordinance is held to be invalid or unconstitutional by any court of competent jurisdiction, then the said holding will in no way affect the validity of the remaining portions of this Ordinance.

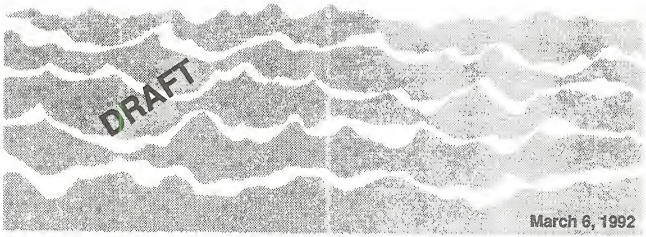
Section 24. EFFECTIVE DATE

24.01 This Ordinance will become effective as provided by law.

APPENDIX G

STATE WATER PLAN
GROUNDWATER RECOMMENDATIONS

MONTANA WATER PLAN



Section: Integrated Ground Water Quality and Quantity Management

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INTRODUCTION

The use and development of water have been essential to the settlement and growth of Montana. Over the years, several laws and policies have been developed to protect the rights of individuals to use water for a variety of purposes. These early laws and policies focused on the use of water and, with very few exceptions, do not consider the quality of that water.

In response to the growing use and increased potential for water degradation, a separate body of laws and policies has been enacted to protect the quality of Montana's water. While these laws and policies must consider the beneficial use of water, they do not consistently consider the future allocation of water in the state. The result is a general lack of coordination in the management of the state's water. The state's existing legal and institutional framework for water management does not adequately reflect or take into account the integral relationship between water use and water quality.

The Montana State Constitution, however, requires the state to "maintain and improve a clean and healthful environment ... [and to] provide adequate remedies for the protection of the environmental life support system from degradation and provide adequate remedies to prevent unreasonable depletion and degradation of natural resources" (Article IX, section 1), including water quality.

The Constitution also requires the state to recognize "All existing rights to the use of any waters for any useful or beneficial purpose ..." (Article IX, section 3). To satisfy these constitutional mandates, it appears that water use and the protection of water quality should be integrated both in policy and practice.

BACKGROUND

Ground Water Allocation

Ground water is allocated in Montana by permit or notice of completion of a well. Use of ground water at a rate of 35 gallons per minute (gpm) or less, not to exceed 10 acre-feet per year, is granted a water right upon the filing of a notice of completion with the Department of Natural Resources and Conservation (DNRC). The DNRC must issue a certificate of water right if the notice is complete and correct and if the use is outside the boundaries of a controlled ground water area (Water Use Act, Section 85-2-306, MCA).

A permit is required for all wells and developed springs using more than 35 gpm or more than 10 acre-feet per year. If the purpose of water from more than one well or spring from the same source aquifer could have been accomplished by a single appropriation, and combined withdrawals exceed 35 gpm or 10 acre-feet per year, a permit also is required. The DNRC must issue a well permit and certificate of water right if water is available; if the use does not adversely affect the water rights of prior appropriators; if the proposed project works are adequate; if the use is beneficial; and if the use is outside the boundaries of a controlled ground water area (Water Use Act, Sections 85-2-306 and 311, MCA).

It should be noted that ground water rights do not include the power to prevent subsequent appropriations from lowering the water table if prior appropriators still can reasonably use their water rights (Water Use Act, Section 85-2-401, MCA).

Ground Water Quality Protection

Numerous laws and regulatory programs in Montana control activities that have the potential to threaten the environment. There are laws that regulate underground storage tanks, septic systems, mining operations, landfills, hazardous waste, and almost every other activity that poses a threat to the environment. Although most of these laws are unrelated, protection of ground water quality is a dominant consideration for each program. Montana's water quality programs are administered by the Department of Health and Environmental Sciences (DHES).

The Water Quality Act (Section 75-5-101 et seq., MCA) is the primary water pollution control authority in Montana. The Water Quality Act states that it is the public policy to

> conserve water by protecting, maintaining, and improving the quality and potability of water for public water supplies, wildlife, fish and aquatic life, agriculture, industry, recreation and other beneficial uses; and to provide a comprehensive program for the prevention, abatement and control of water pollution.

The Act also states that any

> ... waters whose existing quality is higher than the established water quality standards be maintained at that high quality unless it has been affirmatively demonstrated to the [Board of Health and Environmental Sciences] that a change is justifiable as a result of necessary economic or social development and will not preclude present and anticipated uses of these waters.

The Montana Ground Water Pollution Control System (MGWPCS) (Section 16.20.1001 et seq., ARM) is a regulatory program established under the Water Quality Act to control unregulated sources of ground water pollution. Important aspects of the MGWPCS rules are ground water quality standards, a nondegradation requirement, and a permit system. Sources of ground water pollution, such as

a hazardous waste treatment facility or a mine, that obtain permits from other programs or agencies, are not required to obtain a MGWPCS permit. However, these operations still must satisfy the MGWPCS standards and cannot degrade ground water quality. While the nondegradation policy applies to ground water, existing data is inadequate to determine the quality of ground water on a regional basis.

Other statutes addressing the protection of ground water that are administered by DHES include the Public Water Supply Act (Section 75-6-101 et seq., MCA) and the Sanitation in Subdivisions Act (Section 76-4-101 et seq., MCA). Water systems that serve 10 or more families or 25 or more persons at least 60 days a year are considered public water supplies. Individual and multiple-family water supply systems constructed on subdivided parcels of less than 20 acres are subject to the Sanitation in Subdivisions Act.

Waste and contamination of ground water are prohibited under the Water Use Act. Both flowing and nonflowing wells are to be constructed and maintained to prevent the waste, contamination, or pollution of ground water. It should be noted that this section requires the plugging of wells only if water is flowing out of the well. Plugging is not addressed in the statute for purposes of closing a pollution conduit to the aquifer (Water Use Act, Section 85-2-505, MCA).

Ground water quality also is addressed in the Agricultural Chemical Ground Water Protection Act passed by the 1989 Legislature. Under this Act, DHES is responsible for developing and enforcing ground water quality standards for agricultural chemicals. The DHES also is charged in this Act with monitoring, promoting research, and providing public education in cooperation with universities and other state agencies. The Act requires the Department of Agriculture to develop and enforce agricultural chemical ground water management plans aimed at preventing ground water impairment, minimizing agricultural chemicals in ground water, and protecting present and future beneficial uses of ground water. Both agencies now are publishing rules to implement their respective responsibilities under the Act.

The Department of State Lands regulates mining operations to minimize and reclaim impacts to ground water quality and quantity. Both the Department of State Lands and the Department of Health and Environmental Sciences ensure that mining operations are conducted in compliance with the Montana Environmental Policy Act and the Water Quality Act. Coal mining permit applications must include a detailed description of pre-mine hydrology and a reclamation plan that minimizes "disturbance to the hydrologic balance at the mine site and in associated off-site areas and to the quality and quantity of water in surface-water and ground-water systems both during and after..." mining (Sections 82-4-231, MCA). Coal and uranium prospecting operations must be conducted to completely avoid degradation or diminution of any existing or potential water supply.

Hard rock mining in Montana is regulated under the Metal Mine Reclamation Act (Section 82-4-301 et seq., MCA) and the Water Quality Act. As with coal applications, hard rock permit applications also must contain baseline studies that characterize the existing hydrologic regime. In addition, hard rock applications must contain operating and reclamation plans that demonstrate how ground and surface waters will be protected to ensure long-term compliance with Montana's Water Quality Act. These plans are supplemented by monitoring requirements that agencies use to track the effectiveness of prior planning and implementation. The Act provides for recovery of damages for a water loss in quantity or quality once an investigation establishes that a hard rock mining operation is responsible for the loss.

Water Quality in the Allocation Process

Water quality is considered in the water allocation process through the reasonable use criteria (Water Use Act, Section 85-2-311(2), MCA) and by establishing controlled ground water areas. According to Montana water law, DNRC must consider the reasonable use criteria, including impacts to water quality, for any permit or change applications using ground water in excess of 4,000 acre-feet annually. Given the large quantity of water needed to trigger these criteria, they have not been used to deny or condition any ground water permits or changes.

It is also possible to close an aquifer to further appropriations or restrict or condition ground water allocations on the basis of water quality concerns by establishing a controlled ground water area. The Board of Natural Resources and Conservation, upon a motion of DNRC or by a petition of at least 20 people or one-fourth of the users of ground water in the area, may establish a controlled ground water area. One criteria for designating a controlled ground water area is that excessive withdrawals will cause contaminant migration and degrade [aquifer] quality (Water Use Act, Section 85-2-506, MCA). Only two controlled ground water areas have been created since the law was passed in 1967: South Pines near Terry and Larson Creek in the Bitterroot drainage. No controlled ground water areas have been organized due to water quality concerns.

Water Quantity in Water Quality Decisions

A variety of Montana agencies and programs regulate activities that may potentially affect ground water quality

and quantity. The major emphasis of the environmental permit programs is to protect the environment, including prevention of ground water contamination. The regulated facilities and activities also may have components that impact ground water quantity, such as water supply wells or dewatering conducted for subsurface mining.

Public Water Supply Act standards require that public supply wells be tested to demonstrate that the well can produce one and one-half times the desired low flow rate. The quantity specifications are designed to ensure that an adequate and reliable water supply is available for water users. Small water supply systems covered under the Sanitation in Subdivision Act must provide a sustained yield of at least eight gallons per minute over a two-hour period or five gallons per minute over a four-hour period.

If the specified well yields cannot be achieved, the proposed water system will not be approved by DHES. The approval or disapproval of a water supply system are independent of a water right decision for the same supply well. The DHES and DNRC occasionally will conduct a joint evaluation of the yield tests from a public well to determine the adequacy of the supply and whether it is appropriate to grant a new water right. No analysis of the cumulative impacts on ground water withdrawals caused by multiple private wells clustered in a subdivision is conducted by DNRC.

As part of a permit review, agencies attempt to identify and evaluate all potential impacts to water resources that may be associated with a regulated activity. The proposed activity my be modified or permits may be conditioned to mitigate potential impacts. Mitigation can address both ground water quality and quantity. Measures to protect ground water quality may include redesigning or relocating the facility, requiring a synthetic liner beneath the impoundment, or eliminating the facility altogether by not allowing the impoundment to be constructed in a shallow ground water area. If ground water quantity will be potentially impacted by a proposed production well at a permitted facility, the permitting agency can require the applicant to modify its water withdrawal to reduce or eliminate the impacts. However, ultimate authority to grant or deny a water right permit rests with DNRC.

POLICY STATEMENT

It shall be the policy of the State of Montana to manage and protect ground water quantity and quality as a total resource to ensure aquifer protection and sustainability for existing and future uses.

ISSUES, OPTIONS, AND RECOMMENDATIONS

Issue 1—Coordinate Quantity and Quality Permitting

Permits for ground water allocation and for control of potential ground water pollution sources are granted independently without consideration of cumulative or overlapping impacts.

According to the Water Use Act (Section 85-2-311 (1) (b), MCA), when granting a water right permit an applicant must prove by substantial and credible evidence that "the water rights of a prior appropriator will not be adversely affected." Some interpret this to include water quality while others do not. Due to the ambiguity, the Department of Natural Resources and Conservation has adopted the practice of evaluating effects on water rights of a prior appropriator based solely on quantity. Therefore, water use permits are not conditioned or denied on the basis of known or potential water quality consequences. Further, when ground water permits are granted, it is not known whether the added aquifer withdrawal will affect the water quality of surrounding users or whether that particular well owner will have water of sufficient quality for his or her intended beneficial use.

Conversely, permitted activities such as underground injection of fluids, land fills, waste water storage and disposal, and mining activities may affect the quality of water for various uses. The Department of Health and Environmental Sciences has the authority to permit all activities that affect ground water quality that are not addressed by other agency laws and regulations. Under the Water Quality Act, DHES requires all regulated activities to adhere to the nondegradation policy. The DHES also considers ground water use when evaluating permit applications (such as Montana Ground Water Pollution Control System permits, subdivision approval, or exemptions from the nondegradation rule). However, DHES does not have the authority to condition the water use of an applicant. Currently, DHES does not regularly report to DNRC any known contamination or permitted activities impacting ground water that could affect current uses of the aquifer or foreclose future uses.

Options Recommended

1. Clarify that DNRC has the authority to condition or deny new water use permits and change of use applications based on a preponderance of the evidence and a consideration of whether:
   a) The water quality of a prior appropriator would be adversely affected; or

b) Water quality, as defined by the standards of DHES, would be adversely affected; or

c) The ability of discharge permit holder(s) to satisfy effluent limitations would be impaired.

2. The DNRC shall notify discharge permit holders of new water use permit or change of use applications if the issuance of such permits or changes may adversely affect the ability of discharge permit holders to satisfy effluent limitations.

3. The DNRC and DHES shall establish a process to ensure the water use permitting process adequately considers water quality, and the water quality permitting process adequately considers water quantity.

4. Amend the Water Use Act (Section 82-2-506, MCA) to allow state or local agencies, including local water quality districts, to petition the Board of Natural Resources and Conservation, based on public health concerns, to establish a controlled ground water area. The board shall give special consideration to aquifers designated as sole source aquifers.

5. Amend the controlled ground water area statute (Section 85-2-506(2)(e), MCA) to broaden water quality considerations by allowing a petition based on a showing that excessive ground water withdrawals would cause contaminant migration "or" a degradation of ground water quality within the ground water area. This legislation simply would replace "and" with "or."

6. Require state agencies to develop a central ground water pollution source tracking system for general access through the Natural Resources Information System.

Options Considered But Not Recommended

1. Clarify the Water Use Act (Section 85-2-311, MCA) to allow DNRC to consider ground water quality as criteria for evaluating water right permits so that:

   a) the ground water allocation would not unreasonably interfere with beneficial use of the aquifer; and

   b) the application of quality criteria is technically and economically balanced.

2. Develop a Memorandum of Understanding between the Department of Health and Environmental Sciences and the Department of Natural Resources and Conservation with the following agreements:

   a) Allow DHES to work with DNRC on ground water right permit applications associated with subdivisions or other public water and sewer systems under evaluation by DHES.

   b) Allow DHES and DNRC to initiate planning with local or other government entities on ground water quantity and quality issues.

   c) Require DHES to notify DNRC when violations of water quality standards have been detected in an aquifer that could impact beneficial uses.

   d) Require DNRC to inform permit applicants of known water quality standard violations.

   e) Provide for joint decisions on water allocation and water quality permits for aquifers designated as controlled ground water areas.

3. Require all wells to obtain permits prior to drilling to allow review for water quality and quantity impacts.

4. Amend the law to allow state agencies to object to proposed ground water allocation and quality permits.

5. Develop a process through which a local conservation district would be notified prior to a well being drilled. Through a coordinated effort among local, state, and federal agencies with input into ground water management, the conservation district would issue a permit to proceed. This would create a local data base listing locations of drilled wells and abandoned wells, potential ground water problems, and any drilling activities underway in the area. When water wells must be drilled under emergency conditions, a process would be developed that would not delay necessary drilling.

Issue 2—Long-term Planning

Lack of comprehensive, long-term ground water quality-quantity management.

Montana, like many western states, historically has reacted to ground water problems in a piecemeal fashion, creating a number of programs and regulatory responses that might duplicate each other. However, it is more cost-effective to prevent ground water problems than to react to overdrafts and contamination after the fact. A proactive approach to ground water management is possible to varying degrees. The focus would be on prevention, public education, streamlining regulation, and more effective and efficient coordination of ground water quality-quantity management.

Options Recommended

1. The Department of Natural Resources and Conservation shall create a State Ground Water Coordination Committee. The committee would include representatives of state agencies involved in ground water-related activities, and may include federal and local

governments, public and private interest groups, and interested citizens. The committee would serve and work under the direction of the State Water Plan Advisory Council. The purpose of the committee would be to develop a state ground water plan to coordinate ground water management and identify and address management gaps. The goal would be to prevent ground water pollution and aquifer overdraft in order to sustain current and future beneficial uses.

a) The committee will participate in the new EPA process for developing a comprehensive state ground water protection program. This process should ensure that Montana assumes the lead role and has final jurisdiction in implementing the program.

b) The committee, through its member agencies, will coordinate with the conservation districts to develop and implement nonregulatory, local ground water management plans.

2. The legislature should continue to support the intent and appropriate funding for implementation of the Montana Ground Water Assessment Act to facilitate ground water management and planning.

Options Considered But Not Recommended

1. Legislate the creation of local ground water management areas. The purpose of ground water management areas would be to allow planning for specific aquifers in order to (1) protect the quality and quantity of ground water; (2) meet future water needs while protecting existing water rights; and (3) provide for effective and coordinated management of the ground water resource.

2. Amend the law to allow local water quality districts to request basin closure, and/or object to new permits based on water quantity or quality concerns.

3. Develop a comprehensive ground water management plan by conducting a study to (1) evaluate existing Montana water laws, and (2) develop the most effective and efficient process and organizational structure for managing ground water in Montana at the state and local levels (disregarding current agency responsibilities). A part of the study would evaluate those western states that have water resource agencies with both water quantity and quality jurisdiction. Based on these assessments, determine whether there is a better organizational framework for management of the state's ground water resource.

Issue 3—Well Construction Enforcement

Inadequate well construction standards enforcement.

More than 2,000 water supply wells are drilled and constructed each year in Montana. If not properly constructed and grouted, wells may allow pollutants from land surfaces and from other aquifers to degrade or contaminate ground water systems. The Board of Water Well Contractors has adopted minimum well construction standards to prevent contamination in order to protect the water supply of well users. The DNRC water resources regional office staff are used to enforce well construction standards. Currently, DNRC staff must contact a driller in advance to determine the location for an evaluation. This procedure hinders ground water quantity and quality management because it does not allow for unannounced random inspections or proper enforcement.

The Board of Water Well Contractors licenses well drillers and investigates complaints. During 1991, 23 written complaints were filed by well owners against 15 drillers. The complaints concerned improper grouting, pumping rates less than those shown on well logs, failure to case a hole, failure to complete a well properly, and muddy well water. Several job sites were closed down for failure to have a licensed individual on site. Approximately 50 construction standard violation letters were mailed as the result of a DNRC regional office review of well log reports.

Options Recommended

1. Require the Board of Water Well Contractors to direct all drillers, on a rotating basis, to give prior notice to DNRC of the location of their drilling operations over a specific period of time to allow well inspectors to perform random construction standard compliance evaluations.

Options Considered But Not Recommended

1. Authorize an adequate number of well inspector positions that are independent and qualified. Place the positions in DNRC regional offices to enforce well construction standards. The inspectors will report to the Board of Water Well Contractors, which retains the authority for action against violators. Funding options include the legislature (general fund), fees assessed on water well owners, or fees assessed on well drillers.

2. Require well drillers to call DNRC, toll free, prior to drilling and constructing a water well or to send in a notice card 72 hours in advance. This would allow the regional office staff to randomly check about 10 percent of the wells under construction to ensure compliance with well construction standards. The costs of implementing this option would be associated with the toll-free number and travel time for investigations.

3. Require local county governments to enforce compliance with well construction standards. This approach

would be similar to that in place for lifting septic system restrictions and meeting drain field construction standards. Since more than 90 percent of water wells drilled are associated with domestic home use, local county inspectors would be responsible for ensuring compliance both with water well and septic system construction standards.

4. Provide a voluntary service where an authorized county or regional office official can, upon request, inspect and ensure compliance with proper water well construction standards for a fee.

Issue 4—Unplugged Holes

Inconsistent standards, procedures, specificity, and enforcement in the construction and plugging of mineral exploration, geotechnical, and seismic holes may result in ground water problems.

It is not known how many abandoned or unused mineral exploration, geotechnical, or seismic holes exist in Montana. Estimates vary greatly, but agencies and counties agree that thousands of unplugged bore holes exist throughout the state. According to the Montana Bureau of Mines and Geology, abandoned bore holes that penetrate more than one aquifer will result in the drawdown of one aquifer as it flows down gradient into another aquifer. The intermixing of aquifers results in water-level and hydrostatic-pressure declines in the up-gradient aquifer. An example of this phenomenon is reported by the Montana Bureau of Mines and Geology in the Colstrip area finding that

> The greatest water-level declines have resulted from losses in hydrostatic pressure in the McKay coal bed, even where the bed is not disturbed by mining ... The large numbers of exploration and core holes drilled before mining are suggested as the likely cause.

The aquifers commonly will have differing water quality and hydrostatic pressures, so more pristine ground water systems can be degraded by mixing with an aquifer of lesser quality. Land use practices may degrade a shallow ground water system that can flow down gradient through unplugged holes into a deeper system and introduce contaminants.

Currently, counties are responsible for locating and plugging abandoned holes when a liable company or individual cannot be found. Many times, holes were left by exploration operations from the early to mid-1900s, and the companies no longer exist. Counties do not have the resources to address abandoned bore holes.

The Department of State Lands and the Board of Oil and Gas do have hole-plugging regulations for current operations. However, plugging requirements vary greatly for different types of holes and are enforced inconsistently. Given the probable water quality and quantity impacts to aquifers throughout Montana, the state should take the lead in providing consistent regulations and in plugging holes to protect ground water for current and future beneficial uses.

Options Recommended

1. Direct the Department of State Lands in the area of mining, and the Board of Oil and Gas in the area of oil and gas, to ensure that abandoned or unused mineral exploration, geotechnical, and seismic holes are properly plugged. A high priority should be assigned to areas with known problems from unplugged holes. Incorporate information from public and private sources into an inventory of abandoned and unused bore holes.
2. Encourage use of the resource indemnity trust fund to address nonrenewable resource impacts.
3. The appropriate state agencies shall investigate all hole-plugging requirements and develop a recommendation for a consistent, statewide hole-plugging program. The recommendations should include developing plugging requirements for geotechnical holes and other holes when no regulations exist, and encouraging research into economically feasible and environmentally sound plugging methods and materials.

Options Considered But Not Recommended

None.

Issue 5—Protection from Mining Impacts

Inconsistent protection of ground water quality and quantity from mining impacts.

Protection of ground water quality and quantity is an important issue associated with mining. Mining activities, if not properly conducted, have the potential to contaminate ground water or deplete aquifers. According to a 20-year study by the Montana Bureau of Mines and Geology, "mine-inflow rates and associated water-level or hydrostatic-pressure declines are influenced greatly by the positions of mines within ground-water flow systems." Some mining operations use chemical reagents such as cyanide, acid bromide, and acid chloride, which can leach from the site and pose water quality problems. In addition, mine tailings can leach residual reagents as well as heavy metals such as arsenic. While responsible operators make every effort to minimize environmental impacts, total leachate confinement is not technologically possible, and concern about protection of water resources from mining impacts is a high priority.

Currently, mine ground water discharge plans are reviewed by the Department of State Lands, with oversight

by the Department of Health and Environmental Sciences. The Department of State Lands investigates complaints of water quantity and quality impacts related to mining. If a complaint related to a coal mine is filed, the Coal and Uranium Bureau must report its findings to the complainant within 90 days of receipt of the complaint. If mine-related activities are responsible for the loss either of water quantity or quality, suitable water must be provided immediately. If the unsuitable water is not permanently replaced, the operator's mine permit will be suspended until substitute water is made available.

If a complaint related to a hard rock mine is filed, the Hard Rock Bureau processes the complaint as rapidly as possible, although the Metal Mine Reclamation Act does not define time frames and does not require immediate water replacement. However, the Metal Mine Reclamation Act does provide for an owner to recover damages for a water loss of quantity or quality. The Hard Rock Bureau is required to investigate the complaint and may require the operator to conduct additional studies. If the finding concludes that the loss of water quality or quantity is caused by the operation, the operator must replace the water in like quality and quantity, and the owner can recover damages. If the water is not replaced, the operator's permits may be suspended until substitute water is supplied.

Due to the often-complex nature of the ground water resource, ensuring its protection through statutes, regulations, and investigative procedures may be difficult. When investigating complaints, the agencies may find that baseline studies have not always been adequate to resolve specific questions of impacts to ground water quality and quantity that arise after operations begin.

Options Recommended

1. Amend the Metal Mine Reclamation Act rules (Section 26.4.100 et seq., ARM) to include the Hard Rock Bureau guidelines which define the scope and parameters of study for baseline investigations.
2. The Department of State Lands shall encourage mining companies to solicit citizen participation during the early stages of large-scale mining and exploration programs prior to application submittal. Public input during the development of baseline inventory plans may protect both mining companies and citizens during investigations of impacts to ground water resources once activities begin. While it is recognized that the Department of State Lands must retain final approval of baseline data, public comments should be incorporated into the planning process.

Options Considered But Not Recommended

1. Amend the Metal Mine Reclamation Act to require adequate bonding to replace or restore the quantity or quality of water resources that are reasonably foreseen to be at risk.
2. Amend the Metal Mine Reclamation Act to establish appropriate time frames for hard rock complaint response and resolution.
3. Amend the Metal Mine Reclamation Act to establish proper limitation of the confidentiality clause pertaining to small miners exclusions and exploration licenses to specific proprietary geologic information. Define proprietary geologic information and large-scale exploration projects through the rule-making process.
4. Amend the Metal Mine Reclamation Act to allow the Department of State Lands to collect fees from mining companies to fund investigations of alleged mine-related ground water damages.
5. Authorize the Department of State Lands to use interest on mining bonds to fund investigations of alleged ground water damages from mining operations.

Issue 6—Information/Education

Water resource information is not easily attainable by citizens to assist in private decision-making.

Home, ranch, and business owners throughout Montana are faced with many decisions that affect their water quality and quantity such as well location, proper well construction, quality testing, and septic system placement. It also may be difficult for citizens to comply with laws and regulations when they are not aware of pertinent information; for example, where to properly dispose of waste oil or how often they should pump their septic tanks. Widespread dissemination of resource-related information would assist individuals in protecting their water resources.

Options Recommended

1. The Water Resources Center, in consultation with appropriate agencies, University Extension, Ground Water Information Center, and Natural Resources Information System, shall develop avenues for the dissemination of water-related information and for water resource public education. These strategies may include:
   a) Requesting the Water Education for Teachers (WET) program to incorporate information on ground water protection strategies.
   b) Working with counties, conservation districts, realtors, county extension agents, and other local entities to distribute DNRC's well brochure and other informational materials.

c) Developing radio and television public service announcements related to water quality and quantity conservation.

d) Providing a toll-free number to answer or direct water-related questions.

Options Considered But Not Recommended

1. Hire a water education/information specialist.

PLAN IMPLEMENTATION

Legislative Action

The legislature needs to revise Section 85-2-311, MCA, to specify that DNRC has the authority to condition or deny new water use permits or change of use applications based on a preponderance of the evidence and a consideration of whether: (1) the water quality of a prior appropriator would be adversely affected; (2) water quality, as defined by the standards of DHES, would be adversely affected; or (3) the ability of discharge permit holder(s) to satisfy effluent limitations would be impaired.

The legislature needs to amend the Water Use Act (Section 85-2-506, MCA) to allow state and local agencies and local water quality districts to petition the Board of Natural Resources and Conservation to establish a controlled ground water area.

The legislature needs to amend the Water Use Act (Section 85-2-506(2)(e), MCA) to replace "and" with "or" so that a petition for a controlled ground water area may be based on a showing that excessive ground water withdrawals would cause contaminant migration "or" a degradation of ground water quality.

The legislature needs to support the intent of and appropriate funding for implementation of the Montana Ground Water Assessment Act.

The legislature needs to allocate appropriate resource indemnity trust funds to address nonrenewable resource impacts including a plugging program for abandoned and unused bore holes.

Administrative Action

The Department of Health and Environmental Sciences and the Department of Natural Resources and Conservation need to establish a process to ensure that the water use permitting process adequately considers water quality, and that the water quality permitting process adequately considers water quantity.

The Department of Natural Resources and Conservation needs to provide legal notification to any potentially affected water quality discharge permittee of each application for a water right permit or for change of use.

The Board of Natural Resources and Conservation needs to give special consideration to sole source aquifers in establishing controlled ground water areas.

The Department of Health and Environmental Sciences, Department of State Lands, Department of Natural Resources and Conservation, and Department of Agriculture need to develop a central ground water pollution tracking system for general access through the Natural Resources Information System.

The Department of Natural Resources and Conservation needs to create a State Ground Water Coordination Committee. The committee would include representatives of state agencies involved in ground water-related activities, and may include federal and local governments, public and private interest groups, and interested citizens. The committee would serve and work under the direction of the State Water Plan Advisory Council.

The State Ground Water Coordination Committee shall develop a state ground water plan to coordinate ground water management, and identify and address management gaps. The committee shall submit recommendations to the State Water Plan Advisory Council. The initial tasks of the committee are to:

1. Participate in the EPA ground water initiative by facilitating the development of a comprehensive state ground water protection program.
2. Cooperate with conservation districts in the development and implementation of local ground water management plans.

The Board of Water Well Contractors needs to establish a system requiring all drillers, on a rotating basis, to give prior notice to DNRC of the location of their drilling operations over a specified period of time to allow for random construction standard compliance evaluations.

The Department of Natural Resources and Conservation needs to develop an efficient system to receive drilling locations from well drillers for use by well inspectors.

The Department of State Lands and the Board of Oil and Gas need to initiate a program to plug abandoned or unused mineral exploration, geotechnical, and seismic holes. Efforts should focus on areas with known problems from unplugged holes. The department and board will collect information from public and private sources to inventory abandoned and unused holes.

The Department of State Lands and Board of Oil and Gas need to investigate mineral exploration, geotechnical, and seismic hole-plugging requirements, and develop

recommendations for consistent standards. The recommendations should include plugging requirements for geotechnical and other holes when no regulations exist. The department and board should encourage research into economically feasible and environmentally sound plugging materials.

The Department of State Lands needs to amend the Metal Mine Reclamation Act rules (Section 26.4.100 et seq., ARM) to include the Hard Rock Bureau guidelines for hydrologic studies.

The Department of State Lands needs to encourage mining companies to involve the public at the earliest stages of large-scale mining and exploration programs prior to application submittal.

The Water Resources Center needs to request the Water Education for Teachers program to incorporate information on ground water protection strategies; work with counties, conservation districts, realtors, county extension agents, and other local entities to distribute DNRC's well brochure to new home builders and other citizens; develop public service announcements related to ground water quality and quantity conservation; and provide a central contact to direct water-related questions.

Financial Requirements and Funding Strategies

Funding will be required to support the State Ground Water Coordination Committee. An estimated funding level of $50,000 would be required. An EPA grant should be pursued through the new comprehensive state ground water program to fund the committee, along with a 25 percent ($12,500) state match allocated equally among participating agencies.

Funding will be required for well inspections and a toll-free telephone line. Nominal fees ($10-$20) on water right certificates, permits, and public water supplies should be levied to fund inspections that will benefit these ground water users. Similar fees generating approximately $90,000 are scheduled to sunset on July 1, 1993, which are currently allocated to fund the initial phase of the Ground Water Assessment Act implementation.

Funding will be required to support the hole-plugging program and inventory. Since the magnitude of this endeavor would require substantial funding, the legislature should decide the appropriate amount of resource indemnity trust funds that should be devoted to this effort.

BIBLIOGRAPHY

Getches, David H., Lawrence J. MacDonnell, and Teresa A. Rice. 1991. *Controlling water use: the unfinished business of water quality protection.* Natural Resources Law Center, University of Colorado School of Law.

VanVoast, Wayne A. and Jon C. Reitcn. 1988. *Hydrogeologic responses: twenty years of surface coal mining in southeastern Montana.* Memoir 62. Butte, Mont.: Montana Bureau of Mines and Geology, Montana College of Mineral Science and Technology.

Plan Implementation Summary

Action	Responsibility	Deadline
Issue 1-Coordinate quantity and quality permitting		
Allow DNRC to consider water quality	Legislature	May 1993
Develop a process to notify discharge permit holders	DNRC	December 1993
Establish a process to consider quantity in quality permits	DHES	December 1993
Allow state and local agencies to petition for controlled ground water areas	Legislature	May 1993
Amend controlled ground water area statuteto allow showing of contaminant migration "or" degradation	Legislature	May 1993
Develop pollution source tracking system	DHES, DSL, DNRC, DoAg	December 1993
Issue 2-Long-term planning		
Establish state ground water coordination committee (SGWCC)	DNRC	September 1992
Develop a state comprehensive ground water program	SGWCC	March 1994
Assist conservation districts with local ground water management planning	SGWCC	As needed
Support funding for ground water assessment program	Legislature	July 1993
Issue 3- Well construction enforcement		
Develop a driller notification system	BWWC/DNRC	March 1993
Issue 4-Unplugged holes		
Hole-plugging program and inventory	DSL and BO&G	June 1993/Ongoing
Develop consistent hole-plugging requirements	DSL and BO&G	October 1993
Allocate RIT funds to plug holes	Legislature	July 1993
Issue 5-Protection from mining impacts		
Amend rules to reflect guidelines for hydrologic studies	DSL	June 1993
Encourage mining companies to obtain early public input	DSL	September 1992
Issue 6-Information/education		
Request WET program to include water quality-quantity information	Water Resources Center	September 1992
Distribute DNRC well brochures	Counties and WRC	September 1992/ Ongoing
Develop public service announcements	WRC	September1992/ Ongoing
Provide toll-free number to answer or direct water questions	WRC	December 1992/ Ongoing

APPENDIX H

WELLHEAD PROTECTION AREA
DELINEATION METHODS

The following is an excerpt from the Mountain Water Company's *Missoula Wellhead Protection Program*. This document was prepared by Ray Lazuk of Hydrometrics, Helena, MT. The project was funded by Mountain Water Company and grants from the Environmental Protection Agency and the Montana Water Quality Bureau.

3.2 WHPA DELINEATION CRITERIA

When establishing WHP programs, community goals and capabilities, in addition to site-specific aquifer conditions, become important factors governing the size of a WHPA and to what degree the wellhead should be protected. The EPA (1987b) provides guidance for WHPA delineation criteria and selection of delineation methods.

There are a number of delineation criteria which are used as conceptual standards to define a WHPA. Each criterion includes a set of threshold values which provide a desired degree of protection and subsequently determine the appropriate size of the WHPA. The EPA identifies five types of criteria that can be used for WHPA delineation:

- Distance
- Drawdown
- Time of travel
- Flow boundaries
- Assimilative capacity

Distance

The distance criterion delineates a WHPA using a selected radial distance from a pumping well. The distance away from the well (which defines the

outer boundary of the WHPA) is commonly made arbitrarily with limited technical consideration. A common use of the distance criterion is the establishment of "setbacks" for wells from septic systems to provide microbiological protection zones.

Drawdown

The drawdown criterion is based on the well's "area of influence" which outlines the lateral distance within which the water table is physically lowered by pumping. A threshold value would be some specified amount of drawdown that is observed away from the well. The threshold value can be selected arbitrarily but could also include hydraulic properties of the aquifer, such as the amount of drawdown which induces significant volumes of water to flow preferentially toward a well. The distance from the well to where this specified drawdown occurs would then form the outer boundary of the WHPA.

Time of Travel

The time of travel (TOT) criterion considers the minimum time it would take a contaminant traveling within groundwater to reach a wellhead. The TOT is determined from groundwater flow velocities. However, accurate determinations of groundwater flow velocities are often difficult because they require accurate measurements of aquifer properties including hydraulic conductivity (permeability), porosity, hydraulic gradient, and groundwater flow direction. TOT threshold values can be based, in part, on knowledge of the physical (or biological) properties of the contaminants of concern (e.g., bacterial life span), filtering or dilution capability of the aquifer, and

cleanup response time necessary for aquifer remediation in the event that a contaminant is introduced to the aquifer.

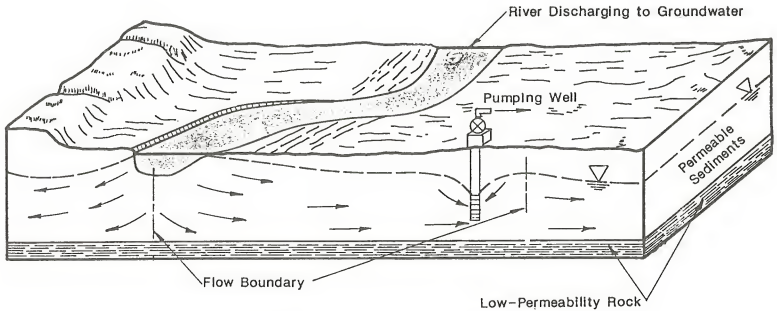
Flow Boundaries

The flow boundary criterion relies on the presence of groundwater flow boundaries (divides) which influence the direction of groundwater flow. In essence, the flow boundary criterion is identical to use of the ZOC to delineate WHPAs. A conceptual depiction of the use of flow boundaries is given in Figure 3-11.

Assimilative Capacity

The assimilative capacity criterion considers the ability of the aquifer material or overlying unsaturated material to reduce the concentrations of potential contaminants to acceptable concentrations before they reach a well. Attenuation mechanisms could include adsorption of dissolved contaminants onto the aquifer material, precipitation of contaminants onto aquifer material, and microbial degradation of organic compounds. This criterion is difficult to quantify, however, given the complex geochemical reactions which are responsible for attenuation. Possible assimilative capacity in the Missoula Aquifer could be provided by the fine-grained Unit Two material present in various portions of the aquifer. Unit Two may provide a protective layer for wells completed in the deeper strata of Unit Three.

Examples of actual use of distance, drawdown, TOT, and physical boundaries criteria, along with selected threshold values, are in Tables 3-3 through 3-6 (EPA, 1987b).



Not To Scale

Figure 3-11
Conceptual Flow Boundary Criterion

TABLE 3-3. DISTANCE: WHPA CRITERION THRESHOLD VALUES

Range of Threshold Values for WHPA Criteria (ft.)	Rationale	Locality	Brief Description of Hydrogeologic Setting	Example of Maximum Distance of WHPA Boundary from Well (ft.)	Pumping Rate (gpm)
2,500 (fixed circle)	"...to be sure that the zone of contribution...would be protected until the upcoming study has been completed..."	Edgartown, MA	Thick deposits of stratified glacial drift. Coastal Plain geologic province.	2,500	700
1,320 2,640 3,960 5,280 (fixed circles)	"...provide a means to quickly focus attention on special use, provide a protected buffer to dilute contaminants which flow into it and reduce the administrative complexities and expenses associated with delineation."	State of Pennsylvania (proposed)	Seven geologic provinces. Heavily folded and fractured sedimentary rocks in the eastern half of State grading to thinly bedded horizontal sedimentary rocks in western half. The northern border is covered by thin layers of glacial till and the southeast chiefly by foliated metamorphic units.	1,320 2,640 3,960 5,280	<7 7-35 35-69 >69
1,000 (fixed circle)	Same threshold used for other purposes.	Nebraska	Three geologic provinces. Extensive alluvial aquifers in west and central NE. Buried valley and sandstone aquifers in east NE.	1,000	Irrespective of Q

TABLE 3-3. DISTANCE: WHPA CRITERION THRESHOLD VALUES (continued)

Range of Threshold Values for WHPA Criteria (ft.)	Rationale	Locality	Brief Description of Hydrogeologic Setting	Example of Maximum Distance of WHPA Boundary from Well (ft)	Pumping Rate (gpm)
6,563 (2 km) (fixed circle)	"The distance originates from past experience in the industry, that no pollution effects had been found originating at larger distances (Zone III A)."	W. Germany	Varying hydrogeologic conditions and depths to water. Fractured sandstone and limestone aquifers frequently connected to surface water. Unconsolidated aquifers in valleys.	6,563	Irrespective of Q
10,560 (2 miles) (circular)	"...indicates the distance contaminants could be expected to move in problem concentrations should they be accidentally introduced into the groundwater system."	United States (EPA Classification Review Areas)	Can be expanded depending on specific hydrogeologic considerations (e.g., high groundwater velocities), water velocities.	10,560	Irrespective of Q

Source: Guidelines for Delineation of Wellhead Protection Areas, U.S. EPA, June 22, 1987.

TABLE 3-4. DRAWDOWN: WHPA CRITERION THRESHOLD VALUES

Range of Threshold Values for WHPA Criteria (ft.)	Rationale	Locality	Brief Description of Hydrogeologic Setting	Example of Maximum Distance of WHPA Boundary from Well (ft.)	Pumping Rate (gpm)
0.25 (for westerly boundary)	"...the protection area west of the turnpike is defined by the quarter-foot (0.25) drawdown, as compared to easterly boundary...which is determined by water divide." "The selection of this protection area...was based on the rationale that land should not be released for incompatible development in the short run that would later have to be reincorporated into the regulatory boundaries."	Dade County, FL	Biscayne Aquifer is composed in most part by solution-riddled limestone, sandstone, and sand. It is a highly permeable wedge-shaped unconfined aquifer. Recharged by local precipitation and canals.	23,000	104,000 (northwest well field)
1.0	Suitable for field monitoring.	Palm Beach County, FL	Eastern part of County is considered an extension of the Biscayne Aquifer (see Dade). Sediments consisting of a sequence of unconsolidated sands, loose- to well-cemented limestones. An intricate system of canals controls groundwater levels in the area.	10,500	28,000 (Boynton Beach well field)

Source: Guidelines for Delineation of Wellhead Protection Areas, U.S. EPA, June 22, 1987.

TABLE 3-5. TIME OF TRAVEL: WHPA CRITERION THRESHOLD VALUES

Range of Threshold Values for WHPA Criteria (days)	Rationale	Locality	Brief Description of Hydrogeologic Setting	Example of Maximum Distance of WHPA Boundary from Well (ft.)	Pumping Rate (gpm)
50 (Zone I, TOT Criteria)	"the time required to ensure the natural or appreciable reduction in microbial organisms."	Southern England	All deposits are sedimentary. Eighty-two (82) percent of all groundwater pumped is derived from chalk. The chalk is a very fine-grained fissured white limestone. Groundwater movement is mainly by fissure-flow and is enhanced by solutioning.	8,200	2,750 (for large well fields in chalk)
50	"...protection exerted was against pathogens (bacteria and viruses) and rapidly degradable chemicals."	The Netherlands	A continuously sinking basin in which sedimentation of marine and fluvial sands and clays has taken place. Flat topography and only locally hilly. Little faulting. Mainly uniform, horizontally layered aquifers of unconsolidated sands and clays. Groundwater flow is laminar with velocities ranging from 10-100 m/yr (33-330 ft/yr).	500	1,500 (average well field)

TABLE 3-5. TIME OF TRAVEL: WHPA CRITERION THRESHOLD VALUES (continued)

Range of Threshold Values for WHPA Criteria (days)	Rationale	Locality	Brief Description of Hydrogeologic Setting	Example of Maximum Distance of WHPA Boundary from Well (ft)	Pumping Rate (gpm)
100 (Zone IV)	"...is based on the information which was found in the literature concerning enteric viruses. These viruses have been shown to survive in water and soils for an average of 100 days."	Dade County, FL	Biscayne Aquifer is composed in most part by solution-riddled limestone, sandstone, and sand. It has a highly permeable wedge-shaped unconfined aquifer. Recharged by local precipitation and canals.	5,300	104,000 (northwest well field)
210 (Zone V)	"...represents the longest period of time on record in which the Biscayne Aquifer was not recharged by normal rainfall patterns."	Dade County, FL	(Same as above).	10,000	104,000 (northwest well field)

TABLE 3-5. TIME OF TRAVEL: WHPA CRITERION THRESHOLD VALUES (continued)

Range of Threshold Values for WHPA Criteria (years)	Rationale	Locality	Brief Description of Hydrogeologic Setting	Example of Maximum Distance of WHPA Boundary from Well (ft)	Pumping Rate (gpm)
10	"In the case of severe pollution of a persistent compound within the recharge area, an attempt must be made to repair the damage...For the sake of continuity of water supply and to exclude public health risks, a delay of groundwater in the aquifer of at least 10 years is needed..."	The Netherlands	A continuously sinking basin in which sedimentation of marine and fluviatile sands and clays has taken place. Flat topography and only locally hilly. Little faulting. Mainly uniform, horizontally layered aquifers of unconsolidated sand and clays. Groundwater flow is laminar with velocities ranging from 10-100 m per year (33/330 ft yr).	2,600	1,500 (for average well field)
25	"Because in many cases even 10 years will not be sufficient to guarantee continuity of safe water supply..."	The Netherlands	(Same as above).	3,900	(Same as above)
10 25 50	"...to provide the town with an initial screening mechanism for evaluating the need for corrective action in the event that contamination is detected or a catastrophic spill of hazardous materials...occurs."	Town of Falmouth, MA	Geologic formations include the Mashpee pitted outwash plain deposits, and Buzzards Bay moraine and outwash deposits. The majority of town is situated over the Mashpee pitted outwash plain.	2,500 6,500 12,500	465

Source: Guidelines for Delineation of Wellhead Protection Areas, U.S. EPA, June 22, 1987.

TABLE 3-6. PHYSICAL BOUNDARIES: WHPA CRITERION THRESHOLD VALUES

Range of Threshold Values for WHPA Criteria	Rationale	Locality	Brief Description of Hydrogeologic Setting	Example of Maximum Distance of WHPA Boundary from Well (ft.)	Pumping Rate (gpm)
Topographical and Local Groundwater Divide	"...areas of WHPA's were outlined to encompass the inferred recharge zone to each particular groundwater source."	Vermont	--	3,500	N/A
Fraction of Distance (1/3) to Regional Groundwater Divide	"...under steady state conditions there is a direct relationship between the volume of water pumped from a well and the land area comprising the Zone of Contribution (ZOC).	Cape Cod, MA	Comprises sands, silts, clay, and gravel deposited during the late Wisconsin deglaciation. Deposits are thick, homogeneous outwash plains, and the groundwater system exist as unconfined aquifers within the unconsolidated deposits.	10,500	700
Full Distance to Regional Groundwater Divide	--	Edgartown, MA	--	3,800	700

TABLE 3-6. PHYSICAL BOUNDARIES: WHPA CRITERION THRESHOLD (continued)

Range of Threshold Values for WHPA Criteria	Rationale	Locality	Brief Description of Hydrogeologic Setting	Example of Maximum Distance of WHPA Boundary from Well (ft)	Pumping Rate (gpm)
SCE Canal (easterly boundary)	"The computer modeling indicates that the cone-of-influence will not extend east of the SCE Canal..."	Dade County, FL (northwest well field)	Biscayne Aquifer is composed in most part by solution-riddled limestone, sandstone, and sand. It is a highly permeable wedge-shaped unconfined aquifer. Recharged by local precipitation and canals.	11,000	104,000 (northwest well field)

Source: Guidelines for Delineation of Wellhead Protection Areas, U.S. EPA, June 22, 1987.

3.3 WHPA DELINEATION METHODS

There are six technical methods recommended by the EPA (1987b) which transfer delineation criteria into actual WHPA boundaries. In order of increasing technical complexity, they are:

- Arbitrary fixed radii
- Calculated fixed radii
- Simplified variable shapes
- Analytical methods
- Hydrogeological mapping
- Numerical flow/solute transport models

Arbitrary Fixed Radii

This method involves drafting a circle of specified radius around the well (Figure 3-12). The radial distance criteria threshold is arbitrarily selected but could be based on hydrogeologic knowledge and/or professional judgment. Elements of groundwater TOT and assimilative capacity may also be considered when selecting a radial distance. The advantage of this method is that it is simple to execute. However, only a portion of a well's ZOC will be covered and, in general, the method lacks a scientific basis.

Calculated Fixed Radii

This method uses an equation to calculate a radial distance from the well for a WHPA boundary based on the volume of water which would be pumped from that area over a specified time period. Inputs into this method consist of pumping rate, aquifer transmissivity, porosity or storage coefficient, and the time period of pumping. A time period can be chosen which will provide

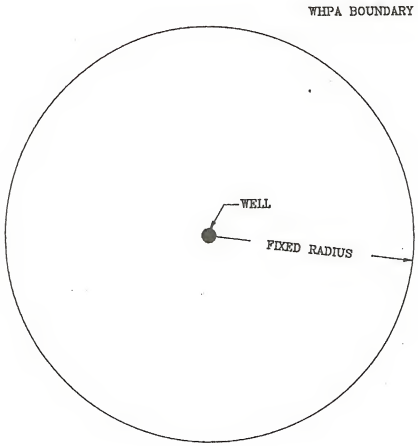


Figure 3–12
WHPA Delineation Using the Arbitrary Fixed Radius Method

an area of sufficient size to allow adequate dilution of contaminants or a clean up of contamination before impacting the well. This method is easy to use and requires limited technical expertise. However, the method only considers part of the ZOC and will oversimplify actual aquifer conditions. The calculated fixed radii method is illustrated in Figure 3-13.

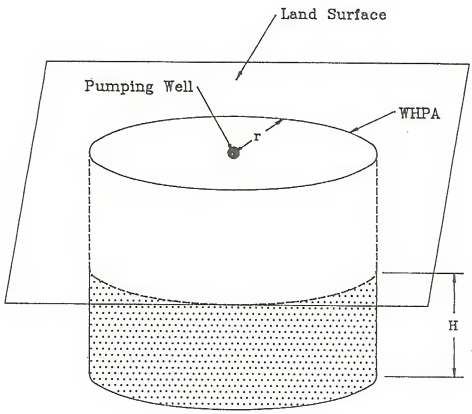
Simplified Variable Shapes

This method uses analytical models (equations) to generate a standardized shape of a WHPA which can be used at one or more wellheads. The lateral and downgradient boundaries of the WHPA are calculated (from groundwater flow equations). The upgradient boundary is then determined using TOT criteria. Figure 3-14 shows examples of variable shapes.

The advantage of this method is that the shapes are easy to calculate, requiring little field information and technical expertise to execute. The main disadvantages, like the calculated fixed radii method, are that the groundwater flow conditions are oversimplified and that the results do not include all of the ZOC.

Analytical Methods

Analytical methods utilize standard groundwater flow equations (Todd, 1980; Theis, 1935) to determine the area of influence and drawdown from a pumping well. This is used with distance, drawdown, TOT, or flow boundaries criteria. Analytical methods are widely used in groundwater studies to assess the effects of pumping wells. Although a number of aquifer properties are taken into account with analytical methods, they generally do not incorporate aquifer boundaries and permeability heterogeneities which can



–Radius (r) is Calculated using a Simple Equation that Incorporates Well Pumping Rate and Hydrogeologic Parameters.

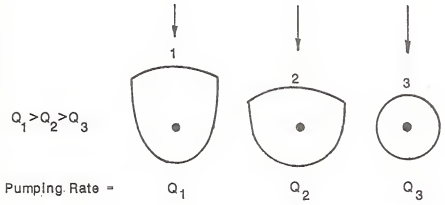
–Radius Determines a Volume of Water that would be Pumped from Well in a Specific Time Period.

H = Open Interval or Length of Well Screen.

Not To Scale

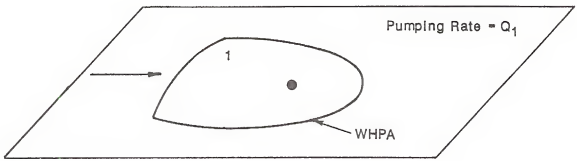
Figure 3-13
WHPA Delineation Using the Calculated Fixed Radius Method

Step 1: Delineation Standardized Forms for Certain Aquifer Type



- Various Standardized Forms are Generated using Analytical Equations using Sets of Representative Hydrogeologic Parameters.
- Upgradient Extent of WHPA is Calculated with TOT Equation; Downgradient with Uniform Flow Equation.

Step 2: Apply Standardized Form to Wellhead in Aquifer Type



- Standardized Form is then Applied to Well with Similar Pumping Rate and Hydrogeologic Parameters.

Not To Scale

LEGEND

- Pumping Well
- Direction Of Groundwater Flow

Figure 3-14
WHPA Delineation Using Simplified Variable Shapes Method

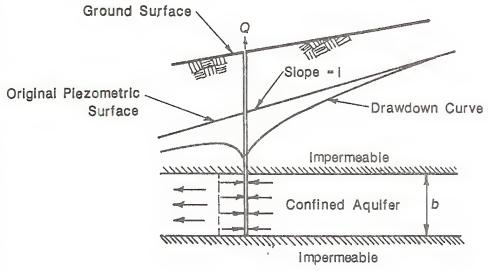
influence the actual drawdown in the aquifer surrounding a pumping well. Figure 3-15 illustrates one type of analytical method.

Hydrogeologic Mapping

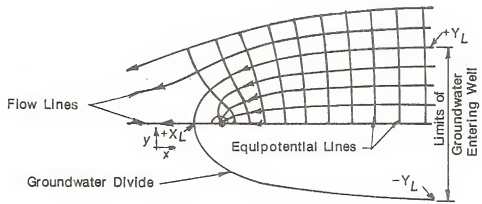
Hydrogeologic mapping uses empirical information (borehole logs, groundwater elevations, aquifer test data, etc.) to define aquifer geometry and groundwater flow patterns. Flow boundary and TOT criteria can then be superimposed on the hydrogeologic map to constrain the boundaries of the WHPA. Provided that data of sufficient quantity and quality are obtained, this method gives good results for accurate WHPA delineations since they are based on actual observations of aquifer conditions. Depending on the amount of available information and size of the aquifer, it is often necessary to make inferences between data points. This makes hydrogeologic experience and professional judgment an essential component in WHPA delineation based on mapping. Figures 3-16 and 3-17 show applications of hydrogeologic mapping.

Numerical Flow/Solute Transport Models

Computer-generated numerical groundwater flow or solute transport models represent a state-of-the-art approach to defining groundwater flow paths. In general, large amounts of data regarding actual groundwater flow patterns and aquifer characteristics are required for model construction. However, once constructed, computer models are quick and flexible in terms of testing the effects of parameter manipulation. For example, drought or high flow conditions can be simulated by using different aquifer recharge rates in the model. The model also allows the user to theoretically test effects on the aquifer from different pumping rates or from additional wells. A number of models are widely used for groundwater studies. Examples of two-dimensional



(A)



$$\underbrace{-\frac{Y}{X} = \tan\left(\frac{2\pi Kbi}{Q}Y\right)}_{\text{Uniform-Flow Equation}} \qquad \underbrace{X_L = -\frac{Q}{2\pi Kbi}}_{\text{Distance to Down-Gradient Null Point}} \qquad \underbrace{Y_L = \pm\frac{Q}{2Kbi}}_{\text{Boundary Limit}}$$

(B)

Legend:

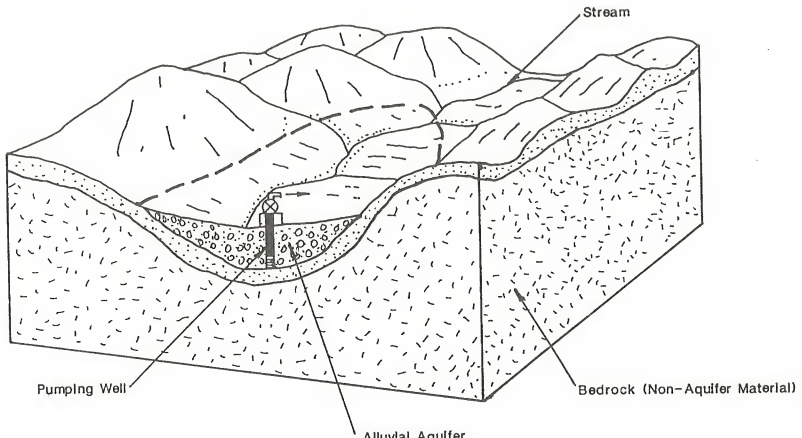
● Pumping Well

Where:
Q = Well Pumping Rate
K = Hydraulic Conductivity
b = Saturated Thickness
i = Hydraulic Gradient
π = 3.1416

Source: Todd, 1980

Not To Scale

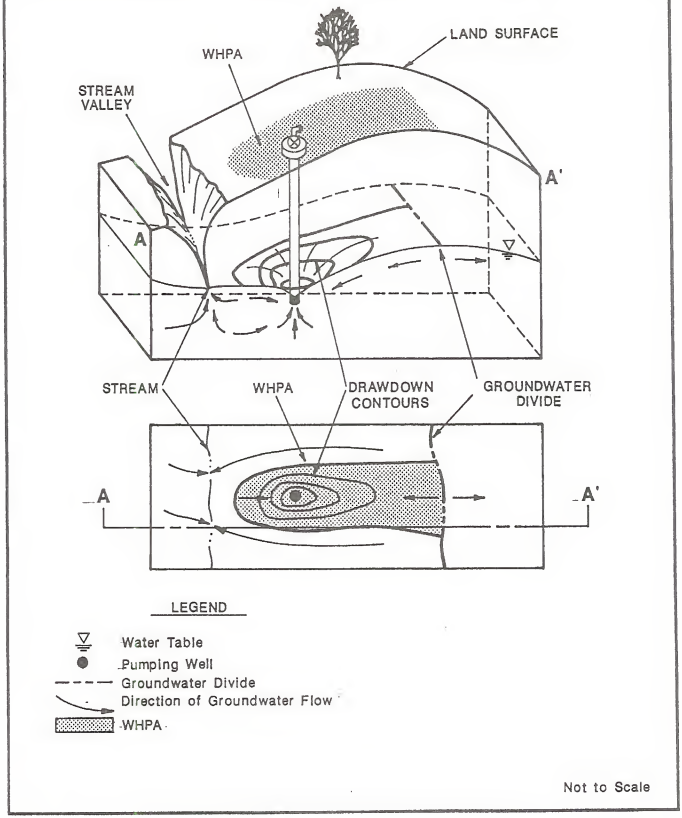
Figure 3-15
WHPA Delineation Using
the Uniform Flow Analytical Model



NOTE: A Secondary Protection Zone Could be Delineated Based on the Larger Area of Recharge from Surface Runoff, and Inferred from Topography and Basin Boundaries.

Figure 3-16

WHPA Delineation Using Hydrogeologic Mapping (Geologic Contacts)



NORTH

Figure 3-17
WHPA Delineation Using Hydrogeologic Mapping (Groundwater Divides)

flow and solute transport models are PLASM (Prickett, 1971), MOC (Konikow and Bredehoeft, 1978) and RANDOM-WALK (Prickett, et al, 1981). MODFLOW (McDonald and Harbaugh, 1988) is one of the most widely used three-dimensional groundwater flow models.

Delineation criteria such as drawdown, flow boundaries, and TOT are easily transferred onto the computer model output. The computer model incorporates elements of both analytical and hydrogeologic mapping methods and therefore provides a good degree of accuracy. However, the more complex the model becomes, the greater the amount of data required for calibration and verification, and the greater the potential for inaccurate results. In complex hydrogeological situations where model accuracy is limited, the effort needed to collect sufficient data for model development can outweigh the benefits gained by its use, thereby making a simpler technique (e.g., simplified variable shapes or analytical model) the more suitable approach.

3.4 PROTECTION GOALS AND CONSIDERATIONS

The EPA (1987b) points out three major considerations which influence selection of delineation criteria and methods:

- Overall protection goals
- Technical considerations
- Policy considerations

The desired degree of wellhead protection should determine the appropriate delineation criteria. For example, if the protection strategy includes a remedial action zone in a WHPA, it could be identified using TOT. The

remedial action zone would begin at a selected distance from the well (based on groundwater flow velocity) that would allow sufficient time to clean up the aquifer before any contaminants reached the well. A well field or aquifer management zone also could be established within the WHPA to protect either all or part of the ZOC to a pumping well. The management zone could be based on drawdown, distance from a well, or groundwater flow boundaries. Table 3-7 (EPA, 1987b) gives the relationships between some of these goals and selection of criteria.

There are also a number of technical factors which should be considered in delineation criteria and method selection. These include:

- Ease of application
- Ability to quantify
- Flexibility to account for changes in hydrologic conditions
- Ease of field verification
- Ability to attain water quality standards
- Suitability for hydrogeologic setting
- Ability to incorporate physical processes controlling contaminant transport

One of the most critical considerations, however, will be policy and management issues. These become important when deciding which WHPA delineation criteria are most suitable to meet the desires and capabilities of the community. For instance, the ease at which the general public understands the concept of a criterion will be important during implementation and enforcement of the WHP program. In addition, the economic

TABLE 3-7. EXAMPLE RELATIONSHIPS BETWEEN OVERALL PROTECTION GOALS AND CRITERIA FOR DELINEATING WELLHEAD PROTECTION AREAS

Overall Protection Goals	Examples of Corresponding Criteria	Example of Criteria Threshold	Advantages	Disadvantages	Hydrogeologic Factors	Management Factors
1. Delineate a remedial action zone allowing adequate reaction time to protect well from contaminant releases.	TOT	5-year TOT to well (State of Florida) 10-25 year TOT (the Netherlands)	Deals directly with most threatening sources in a manner understandable to regulated community; "compatible" with existing programs.	Implies capability/ success of corrective action measures at all relevant sources.	High confidence in accuracy of TOT determinations at specific wellhead areas.	Possible ban of all high-risk activities within WHPA; controls/ monitoring of all significant sources within recharge area, especially those beyond WHPA.
2. Provide a zone for attenuation of contaminants to specified levels before they reach well.	Assimilative capacity	Meet percentage of MCL in raw water supplying well.	Most directly addresses specific contaminants of concern and "standard" in SDWA.	Currently viable only for simple problems such as microbial contaminants; conservative parameters (e.g., synthetic organics) more problematic.	Analysis sufficiently thorough to show that zone is extensive enough to meet target concentrations at well.	Displays understanding of contamination sources, sources, locations, contaminant characteristics, and impacts of controls.
3a. Provide a well field management area in major portion of recharge area.	Drawdown distance	0.25-foot drawdown contour (Dade Co., FL) 2 km (W. Germany)	Broadest definition: can be tailored by States as appropriate; can incorporate other options.	May lead to "over-protection" in some States; "under-protection" in others.	Based on reasonable application of hydrogeologic concepts to available data.	Based on reasonable consideration of relevant management factors.
3b. Manage entire recharge area under current and foreseeable conditions.	Flow boundaries	Physical limits of aquifer and surface drainage (some parts of Massachusetts).	Can be interpreted as most protective; especially appropriate to small aquifers (e.g., less than 10-20 square miles).	Over-protective for moderate to large aquifers.	Analysis shows full recharge area under existing and potential pumping scenarios.	Controls extend to all potential contamination sources within recharge area.

Source: Guidelines for Delineation of Wellhead Protection Area, U.S. EPA, June 22, 1987.

repercussions associated with any land use controls resulting from the selected criteria become significant factors. WHPA boundaries resulting from a selected criterion also must be defensible should they be challenged by persons directly affected by the delineation. Once the delineation criteria are selected, they should be applicable to all regions in the aquifer to provide consistency in the event future WHPAs are added.

Ultimately, the most important factor for criteria selection is whether or not the criteria will meet the specified protection level for the wellhead. A possible relationship between the three major consideration factors is shown schematically in Figure 3-18.

The overall protection goal for MWC wells in the Missoula Aquifer is to protect groundwater quality in the entire ZOC of each well using a flow boundary criterion. However, this protection goal makes establishment of WHPAs for MWC wells in the Missoula Aquifer especially challenging due to the significant urban development in the area of the wells. Because of existing development, management of these areas will require important policy decisions by local government due to the potential impacts to property owners and businesses which are within the ZOC boundaries. The MCCHD together with MWC have expended considerable effort to educate the citizens of Missoula and increase public awareness of the vulnerability of the aquifer and the need to protect this resource. Public education will, therefore, be a critical element in implementation of WHP.

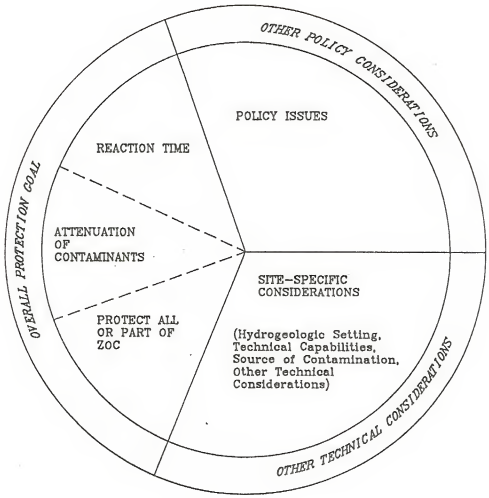


Figure 3-18
Consideration Factors That May Affect Criteria Selection